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Commonwealth of Kentucky FutureGen Proposal

Summary

Kentucky is a magnificent place of natural beauty, inviting communities and industrious people. The unbridled spirit of our Commonwealth is renowned. Kentucky has much to offer. From the Eastern and Western Coal Fields, to the Lake Lands, to the lush hills of the Bluegrass Region, there are countless reasons to visit, live and work in the Commonwealth. Our natural resources and friendly citizens provide a quality of life that is matchless. Kentuckians take pride in their rolling landscapes, historic small towns, visual and performing arts, history and cultural heritage, lakes, caves, world-class dining and shopping, horse and auto racing and college athletics.

Kentucky is the nation's third largest coal producing state producing 119 million short tons in 2005 and containing 1.1 billion tons of recoverable coal reserves at active mine sites. Kentucky has two distinct coal fields, each containing numerous deposits of bituminous coal of various characteristics and mines of every type and size. Kentucky's coal industry employs over 15,000 people at an average wage of \$47,000 per year.

Over ninety percent of Kentucky's electricity is generated from coal. This fact has proven to be significant for the Commonwealth in that Kentucky enjoys some of the lowest rates of electricity in the nation. The viability of coal as a clean energy resource is vital to Kentucky and to the nation to preserve low-cost electricity.

Kentucky is also a leader in the deployment of advanced clean coal technology. When releasing Kentucky's comprehensive energy strategy, Governor Fletcher stated, "Kentucky is open for the clean coal business." Since 2004, over \$2.1 billion in base load, clean coal generation has been announced in the Commonwealth.

There is universal support from the various levels of political leadership for the FutureGen project to be sited in Kentucky. Statements of support include:

- **Governor Ernie Fletcher:** "Kentucky's proposal offers a tremendous set of attributes that would provide the Alliance with an excellent location to construct the FutureGen project."
- **U.S. Senator Mitch McConnell:** "I hope that you will realize the importance of this initiative to Kentucky and to the nation and give appropriate consideration to this application."
- **Congressman Ed Whitfield:** "I am aware that several states will submit proposed FutureGen sites. I am confident that none will offer a better combination of site characteristics, abundant coal reserves, research capabilities, experience in clean coal technology and support of its state government leaders and Congressional delegation."
- **U.S. Senator Jim Bunning:** "I support Kentucky's proposal and believe it will allow the FutureGen project to move forward with the full backing of the people, government and industry of Kentucky."

Given the state's business climate, its heritage and history as a coal producing state, its commitment to coal fueled generation as a low cost energy provider, its status

as a leader in the deployment of clean coal technology and the overwhelming political support for the project, Kentucky is well positioned to be the home of FutureGen.

Kentucky's Financial Commitment to FutureGen

The Kentucky Office of Energy Policy is currently managing the Commonwealth of Kentucky's efforts to attract the FutureGen project. The recently enacted state budget allocated \$7 million to the Kentucky Office of Energy Policy over the next biennium for energy research and development "which shall be used for research projects relating to clean coal, new combustion technology...and the development of alternative transportation fuels produced by processes that convert coal." The FutureGen project clearly meets these criteria.

Therefore it is the intention of the Commonwealth of Kentucky to utilize a portion of these resources to advance the FutureGen project's objectives and put forth the following financial commitments:

- Per the requirement of Section 1.5.7, the Kentucky Office of Energy Policy will provide up to \$200,000 to prepare an Environmental Information Volume should Kentucky's site be selected as a Candidate Site.
- The Kentucky Office of Energy Policy will provide up to \$1 million for further site characterization should Kentucky's site be selected as a Candidate Site.
- The Kentucky Office of Energy Policy will purchase the proposed site acreage and sell the site to the FutureGen Industrial Alliance for \$1 should Kentucky's site be selected as the Preferred Site.
- The Kentucky Office of Energy Policy will provide up to \$500,000 to construct a barge loading/unloading facility should Kentucky's site be selected as the Preferred Site.
- The Kentucky Office of Energy Policy will provide up to \$200,000 for the application fee for the Industrial Alliance to comply with Kentucky's regulatory framework for siting electric transmission facilities at the point that such a requirement becomes necessary.

Attributes of the Proposed Site.

The approximately 215 acre site proposed by the Commonwealth of Kentucky as host for the FutureGen facility is located in Henderson County, Kentucky. Some of the defining characteristics of the Commonwealth's FutureGen facility include:

- An underlying geology that demonstrates great potential for carbon sequestration.
- A mine mouth site that provides ample coal production less than one mile away.
- A location on the Green River that provides a sufficient water supply for the project.
- A location near the Green River's confluence with the Ohio River, providing access to a strategic transportation corridor for construction materials and coal transport.
- Several interconnections for the electricity to be transported to the national grid.

- Accessible to two different natural gas pipeline systems.
- Zoned for heavy industrial development.
- Location adjacent to operating oil wells.
- Located between two four-lane parkways and accessible by improved local roads.

Compliance with Required Criteria

Detailed, one-page responses to individual, numbered sections of the Request for Proposals are provided, consistent with RFP instructions. Each response is referenced as to source; where applicable, maps are included. Additional details are in the Appendix. Summary comments on key sections follow.

Part 1. Power Plant Qualifying Criteria.

The proposed FutureGen Site complies with all criteria stated in the RFP. The site is free from risk of significant seismic events. It is above the 100-year floodplain. No hazardous or radioactive materials or wastes are present. The site is outside restricted air space and controlled air space. No known cultural or archeological resources are present. The site contains no threatened or endangered species or critical habitats. It is not adjacent to a public access area. The site is more than 115 km from the nearest Class I Visibility Area (Mammoth Cave National Park). It is adjacent to abundant, available water supplies from the Green River. Finally, the site is capable of receiving coal delivery by at least three transport modes.

Part 2. Geologic Storage Qualifying Criteria.

The proposed FutureGen Site complies with all stated criteria. The site is not located in proximity to a U.S. or State border. It is not located near marine shorelines or lakes or other public access areas. The site is not located near sensitive features such as dams, water reservoirs, hazardous materials storage facilities or other sensitive features. The Kentucky Geological Survey determined that the site contains no known economically valuable mineral resources in or adjacent to target formations at depth. No known subsurface sources of potable water are present in and around the target formations. It is well-positioned above primary and secondary target formations (saline aquifers as well as an organic shale) for carbon sequestration. There are no known access restrictions to land above target formations. The primary target formation is the Knox Supergroup, at depths of approximately 7,400 feet below ground level. The Knox Supergroup across the region has well-developed porosity zones, capable of accepting 100 percent of injected carbon dioxide, without artificial stimulation. Multiple seals occur above the Knox, comprised of dense dolomite, and stratigraphically higher strata such as the Black River carbonates (up to 575 feet above the Knox), the Maquoketa Shale (up to 1,250 feet above the Knox) and the New Albany Shale (up to 2,890 feet above the Knox).

The Curdsville Fault, which is not active seismically, is inferred beneath the alluvium just southeast of the Site and has been interpreted on two of the reflection seismic profiles in the study area. Oil fields are present on both sides of the fault, but no seeps

are known along the fault trace, suggesting that the fault is sealed and not transmissive over geologic time.

Part 3. Power Plant Scoring Criteria.

The proposed FutureGen Site complies with all site criteria. The site comprises of approximately 215 acres. The terrain is a reclaimed surface coal mine and is gently rolling topography. Adjacent to the site are additional lands of up to 16,000 acres that may be available for lease or purchase. FEMA maps show that the site does not pose undue risk from hurricanes or tornadoes. As noted previously, the proposed site has been altered due to surface coal mining. The elevation at the site and the ground slope are advantageous to facility development, and the site is protected from the 100-year flood by a levee which was constructed as part of the reclamation effort. Wetlands areas are minimal at the proposed site and along various corridors projected for transmission lines and transportation routes. Road access to the site is more than adequate and river access to the site assures that roads in the vicinity will not be the only transportation alternative.

Site characteristics are very favorable and take advantage of the unique nature of the chosen area. All of the CO₂ injection wells within the plume area will be accessible at the surface. The site itself is zoned for Heavy Industrial usage; does not contain any adverse characteristics in the form of sensitive areas or critical habitat; and is adjacent to a readily available source of fuel. The proposed site offers several options for inter-connection to the electrical grid and for access to nearby natural gas pipelines. The proposed area has excellent human resources as well. Population centers in the region can provide the necessary workforce for the proposed plant, and the City Cost Index for the nearest town is well below the U.S. 30-city average. In addition, Kentucky's workforce is more productive than the U.S. average, and Kentucky has received national recognition for its workforce training programs.

Necessary permits for the FutureGen facility will be accomplished through an efficient state regulatory mechanism that has vast experience with natural resource and environmental issues. The air permit will be administered by the state's Division for Air Quality which has experience with two other air permits for gasification facilities including to the immediately adjacent proposed IGCC facility. Water withdrawal requirements for the FutureGen plant represent a minor allocation for the Green River even during low flow conditions.

Part 4. Geologic Storage Scoring Criteria.

The proposed FutureGen Site complies with the stated criteria. The primary injection target for the FutureGen site is the Knox Supergroup. It can contain 100 percent of the projected CO₂ plume. The Knox is a regionally thick and extensive dolomite with well-developed porosity zones. Kentucky has also identified several alternative injection targets to demonstrate the proposed site's ability to sequester CO₂ as a supercritical fluid in fractures, dissolved in water filling the fractures, or adsorbed primarily on the dispersed organic matter in a shale matrix. Research on each of these alternative storage states at this site can be valuable in the selection of future sites. Kentucky's vast experience with coal mining and oil and gas production has put into place an orderly process

to allow access to surface and subsurface areas for monitoring, mitigation and verification activities.

Part 5. Best Value Assessment

The proposed site location chosen by Kentucky provides the best value to the FutureGen Alliance and the consumers of the various products produced by the project. The proposed site is one that achieves the overall objective of cost-efficient production of electricity and hydrogen from diverse coal types and offers enhanced economic benefits.

When the proposed project is evaluated in terms of the best value criteria, it is apparent that Kentucky's submittal will provide the best combination of cost effective production and unique economic benefits, a number of which are highlighted below:

- Kentucky's FutureGen site will be purchased by the Commonwealth of Kentucky and "donated" to the FutureGen Alliance if Kentucky is selected as the Preferred Site.
- The Kentucky Office of Energy Policy will provide up to \$1 million for further site characterization should Kentucky's site make the Candidate Site list.
- The Kentucky Office of Energy Policy will provide up to \$200,000 to prepare an Environmental Information Volume should Kentucky's site make the Candidate Site list.
- The Kentucky Office of Energy Policy will provide up to \$200,000 for the application fee for the Industrial Alliance to comply with Kentucky's regulatory framework for siting electric transmission facilities should Kentucky's site be selected as the Preferred Site.
- The Kentucky Office of Energy Policy will provide up to \$500,000 to construct a barge loading/unloading facility should Kentucky's site be selected as the Preferred Site.
- The Commonwealth of Kentucky will appoint a "permitting liaison" for the FutureGen project to ensure the state permitting process is coordinated and expedited to the greatest extent possible.
- The site provides potential for enhanced oil recovery of 40 million barrels of crude oil within 25 miles of the site and potentially 450 million barrels within 110 miles of the site.
- The proposed site potentially allows flexible operating characteristics including shared facilities for waste disposal, barge loading and unloading facilities, sediment ponds, water withdrawal, and air pollution control by virtue of its location adjacent to a property being developed for a merchant electricity generating station.
- Kentucky has a substantial energy research base within its universities, and the Kentucky Office of Energy Policy will be managing \$7 million in research and development funds over the next two years.
- Utility wastes such as those proposed to be generated by the FutureGen facility are classified as special waste under Kentucky regulations and may be beneficially reused or permitted for special waste landfills.

MultiState Collaboration

The Commonwealth of Kentucky, the Commonwealth of Pennsylvania and the State of Ohio have entered into a Memorandum of Understanding (MOU) to memorialize a collaborative relationship amongst its member states. The MOU permits any member state the option of submitting a response to the FutureGen site solicitation. It then states:

Should a Member State's proposal not be selected by the FutureGen Industrial Alliance to advance through the several stages of the site evaluation process, as defined in the Alliance's Final Request for Proposals, that Member State agrees to support proposal(s) from other Member States that survive the screening process and are included in the "Candidate Site List" to be submitted by the Alliance to the U.S. Department of Energy.

Given that the FutureGen Alliance is likely to consider a range of possible sites, it is recognized that multiple sites from the member states could make it to the "Candidate Site List." Therefore, the competition for selection for the Preferred Site would continue.

Ultimately, though, the members of this MOU agree that a site within a member state is preferable and will be supported by the MOU's signatories.

Further, the signatories of this MOU have organized the Ohio River Valley Coal Research Consortium. The signatories believe that there is significant research capacity within the universities of the member states that could be a tremendous asset to the FutureGen Alliance.

Membership of this Consortium includes the University of Kentucky, Penn State, University of Pittsburgh, Ohio State, Ohio University, University of Cincinnati, University of Akron, Case Western Reserve, University of Dayton and Carnegie Mellon.

Other member institutions may also be solicited to join.

Comment on Contractual Terms and Conditions

In anticipation of entering into a contract with the FutureGen Alliance, The Commonwealth of Kentucky agrees to the acceptance of the terms and conditions found in the Request for Proposal, specifically:

- The Commonwealth of Kentucky agrees to comply fully with all applicable federal, state and local laws, rules and regulations with respect to the transfer of the interest in the property, and the Commonwealth of Kentucky agrees that the FutureGen Industrial Alliance shall have exclusive use of the offered property for the term of the contract.
- The laws of the Commonwealth of Kentucky shall govern the Site Agreement.
- The Commonwealth of Kentucky accepts the language in the Request for Proposal regarding force majeure terms and conditions, relationship of the parties, separability clause, and conditions of the termination for the contract.
- The Commonwealth of Kentucky agrees that all prices and payments must be in U.S. dollars.
- The Commonwealth of Kentucky shall have valid title to the property in order to enter into a Site Agreement with the Alliance, and the Commonwealth of Kentucky shall warrant that the property will conform to the specifications in the RFP.

- Short of an amendment to Kentucky's Constitution, the Commonwealth is prohibited from taking title to the CO₂ and/or indemnifying the Industrial Alliance for any potential liability associated with the CO₂ and/or the sequestration thereof.

Conclusion

The Commonwealth of Kentucky applauds President Bush, the U.S. Department of Energy, and the FutureGen Industrial Alliance for putting forth the FutureGen vision. Kentucky's proposal offers a tremendous set of attributes that would provide the Alliance with an excellent location to construct the facility. Kentucky welcomes the opportunity to compete for the FutureGen project and looks forward to working with the Site Selection team.

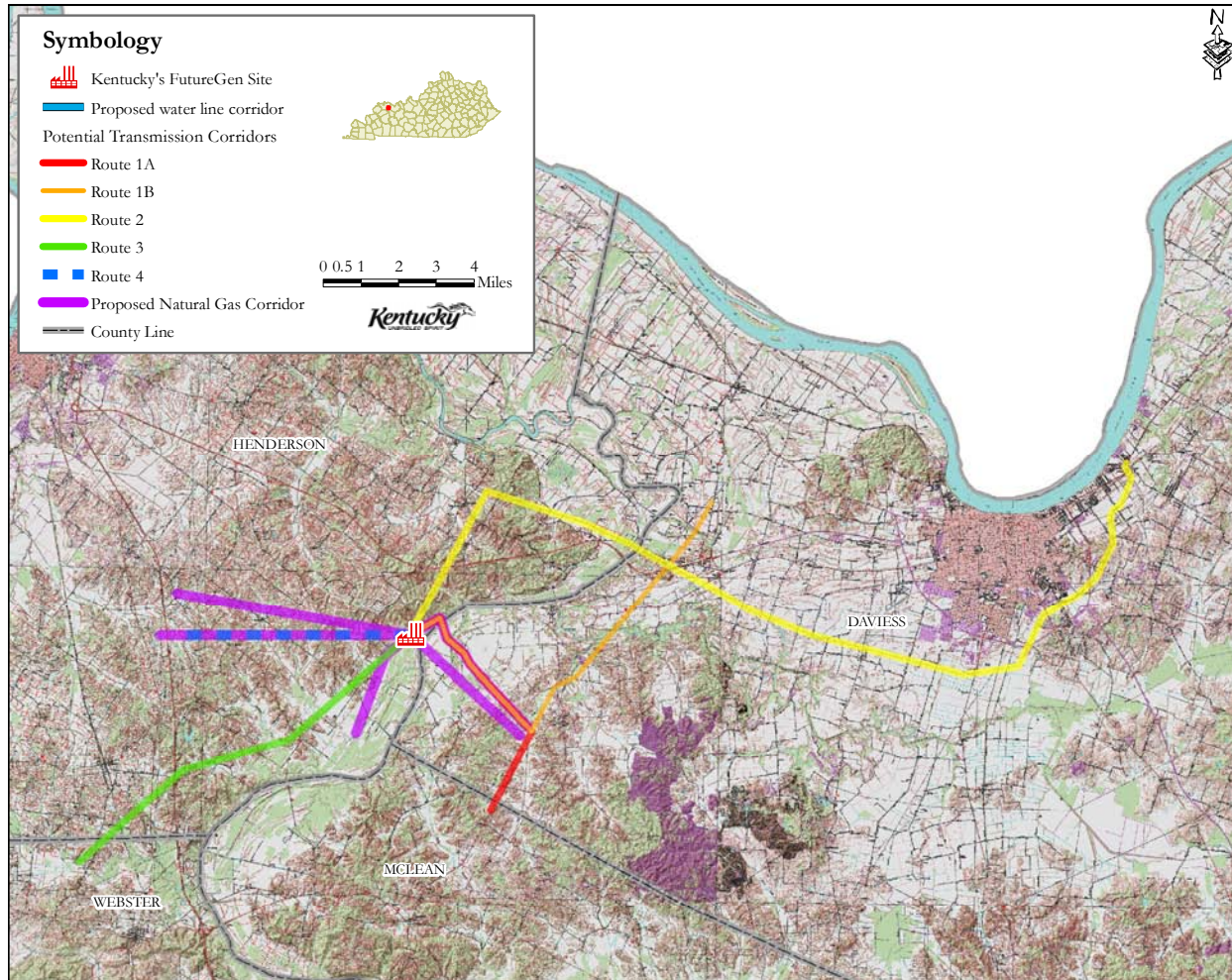
We believe that Kentucky's proposal satisfies or exceeds specific requests for information contained in the Alliance's Final Request for Proposals. We are prepared to respond promptly to questions regarding this proposal, and to welcome representatives of the FutureGen Industrial Alliance to Kentucky for discussions and visits to the proposed site. Questions should be addressed to Andrew V. McNeill, Acting Executive Director, Kentucky Office of Energy Policy, at telephone number (502) 564-4270, or via e-mail at andrewv.mcneill@ky.gov or Talina Mathews, FutureGen project director, at telephone number 502-564-7192 or via e-mail at talina.mathews@ky.gov.

PART 1--Power Plant Qualifying Criteria

1.1. Physical Characteristics.

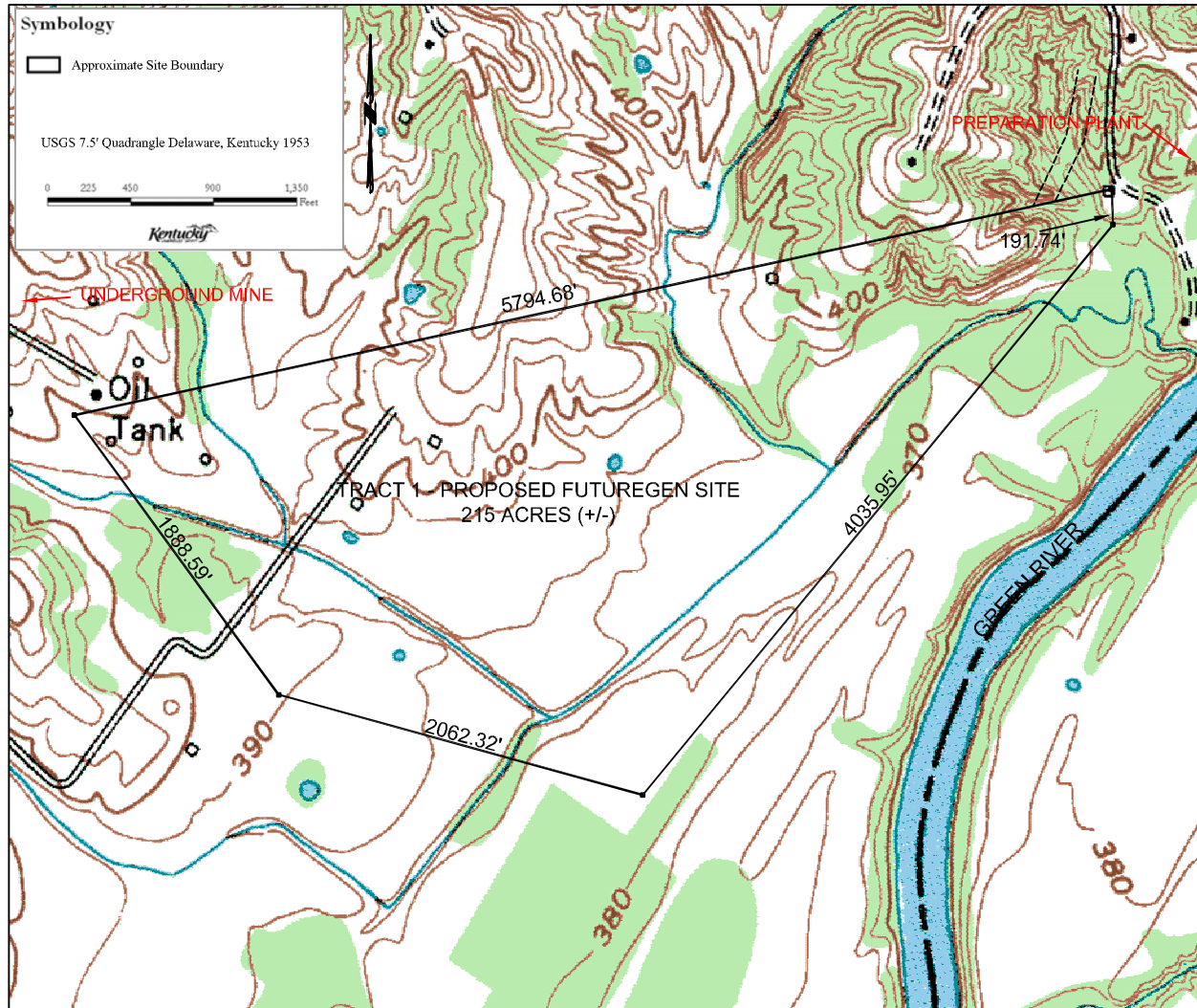
1.1.1. Geographic Location.

The Commonwealth of Kentucky's proposed FutureGen site is an approximately 215 acre site located on the Green River in Henderson County, Kentucky.



1.1.2. Size.

The Kentucky FutureGen site consists of approximately 215 acres, not including the access road, with linear dimensions shown below.



Aerial Photo with Site Boundary included in Appendix 1.1.2

1.1.3. Control.

The Commonwealth has included documents in the Appendix which demonstrate that the proposed FutureGen site will be available for the proposed use. The Commonwealth has entered into agreements with three entities, each of which owns an interest in either the surface real property and/or the subsurface mineral rights of the proposed FutureGen site and/or the property surrounding the proposed FutureGen site. Penn Virginia Operating Co., LLC ("PVOC") and Green Gem, LLC ("Green Gem"), currently hold title to an aggregate of approximately 56,000 acres of real property and subsurface coal and other minerals located along the Green River in Henderson County, Kentucky (See Appendix 1.1.3 - Penn VA MOU). Cash Creek Generation, LLC ("Cash Creek"), acquired approximately 1,920 acres of the real property held by PVOC and Green Gem ("the Master Tract") pursuant to a certain Amended and Restated Option Agreement that also granted Cash Creek the right to acquire certain easements over the property located outside the boundaries of the Master Tract ("the Remaining Property").

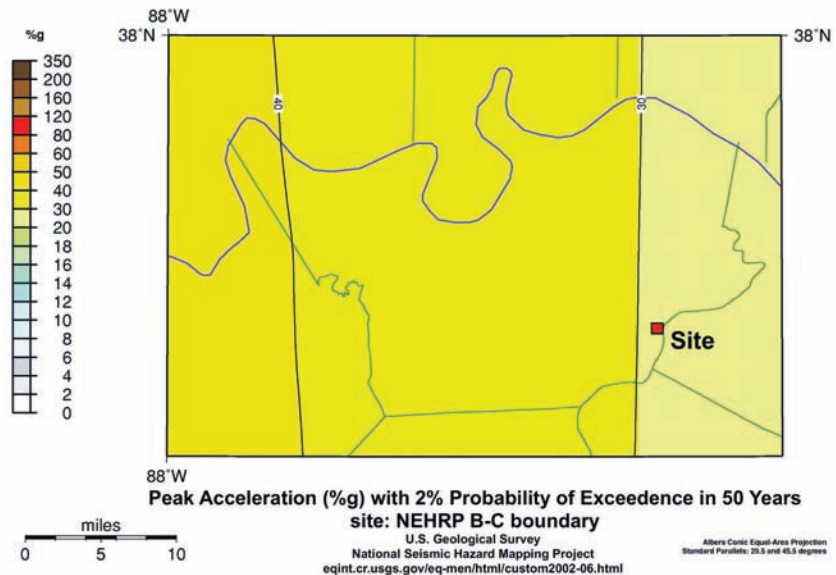
The Commonwealth entered into an Option Agreement (see Appendix 1.1.3 - Option Agreement) with Cash Creek in May of 2006 wherein the Commonwealth was granted an option to purchase the proposed FutureGen site, which is located within the Master Tract purchased by Cash Creek. (Green Gem also signed the Option Agreement, acknowledging its consent to the provisions thereof.) Also included in the Appendix 1.1.3 is the Owner's Policy of Title Insurance issued to Green Gem, which owned the portion of the Master Tract that includes the proposed FutureGen site prior to Cash Creek's acquisition of the Master Tract. After the Commonwealth exercises its option, it intends to donate the site property to the Alliance as evidenced by the Deed of Conveyance included in the Appendix.

Documents included in the Appendix also demonstrate the availability of rights-of-way for all necessary transmission line, transportation, and pipeline corridors. As previously mentioned, the Amended and Restated Option Agreement between and among Cash Creek, PVOC and Green Gem granted Cash Creek the right to acquire certain easements over the Remaining Property (property located outside the boundaries of the Master Tract). In the Option Agreement, Cash Creek agrees that it will work with the Commonwealth to acquire such easements as the Commonwealth may reasonably require for its intended use of the proposed FutureGen site. (See Appendix 1.1.3 - Option Agreement (Section 9).) Lastly, the Appendix contains a Memorandum of Understanding between the Commonwealth and PVOC wherein PVOC agrees to negotiate in good faith with the FutureGen Alliance and/or the Commonwealth regarding easement rights for reasonable access to and use of the Remaining Property for surface water retention, landfill disposal and other purposes consistent with the proposed use of the FutureGen site. Accordingly, the discussed above sufficiently demonstrate that the proposed FutureGen site offered by the Commonwealth will be available for the proposed use.

1.1.4. Seismic Stability.

The site has low risk from significant seismic events (less than the 30% g) as defined in the FutureGen RFP. According to the U.S. Geological Survey's seismic hazard web site (USGS, 2006, see URL), peak ground acceleration (PGA) for the study site in eastern Henderson County is 29.2 to 29.8% g with a 2% chance of exceedance in 50 years.

USGS estimates for the central U.S. are conservative and are currently being reexamined (USGS/NRC workshop, 2005; Wang, 2005). Recent work in the lower Wabash River valley indicates overestimates of historic earthquakes, which influence current seismic hazard calculations (Olson et al., 2005). Also, recent seismic analyses in Western Kentucky for the Kentucky Department of Transportation indicates that the PGA in Henderson County is 20% g with a 2% chance of exceedance in 50 years (Wang, 2006), which is lower than USGS estimates. The Kentucky Geological Survey operates an extensive seismic monitoring network in Western Kentucky, and has a leading research group involved in continuing seismicity studies in the Illinois Basin.



References

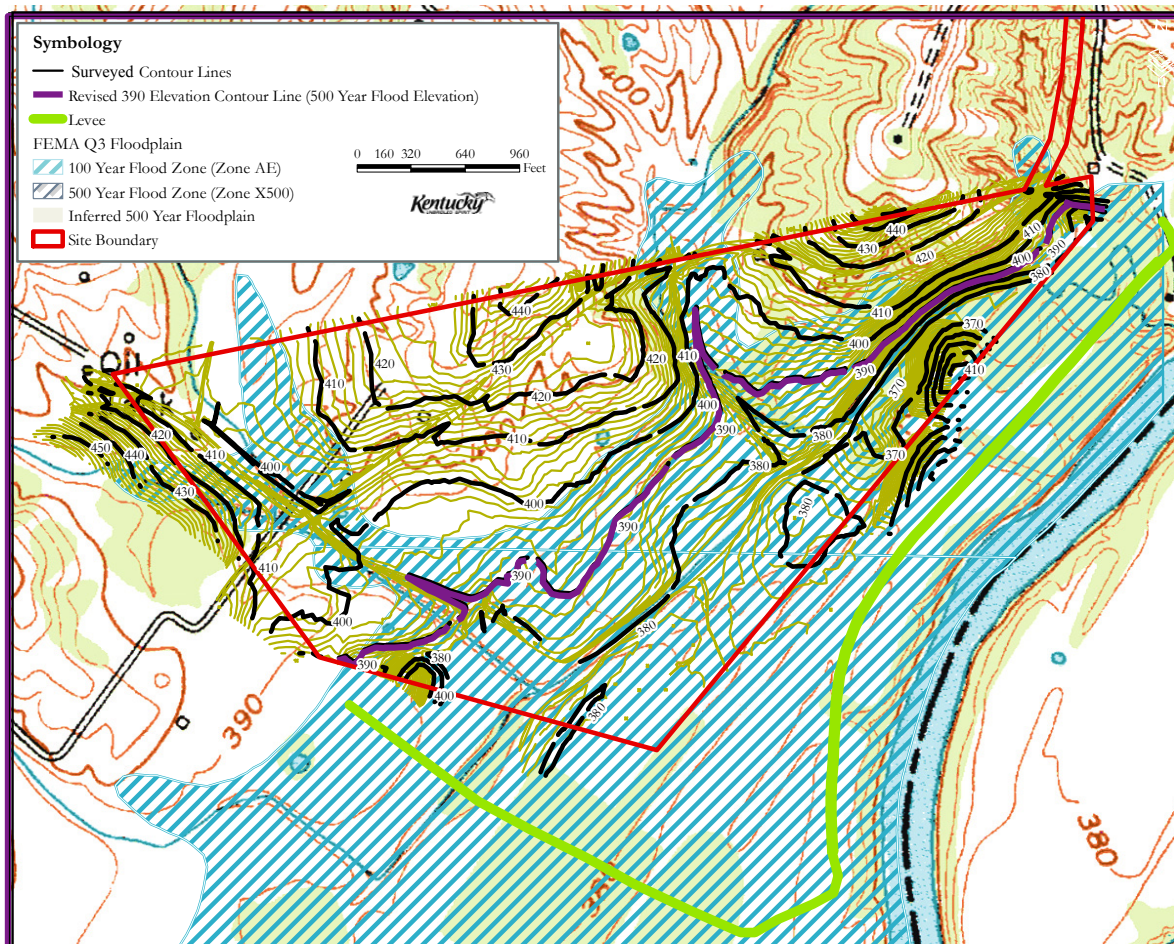
- Olson, S.M., Green, R.A., and Obermier, S.F., 2005, Revised magnitude-bound relation for the Wabash Valley Seismic Zone of the central United States, *Seismological Research Letters*, v. 76, p. 756-771.
- USGS/NRC Workshop on the Attenuation of Ground Motion in the Central and Eastern United States, August 4, 2005, Menlo Park, CA
- Wang, Z., 2005, Better understanding and communication of the national hazard maps: Summary of USGS-KGS meeting on seismic hazard assessments in Western Kentucky: Kentucky Geological Survey, Special Publication 7, 47 p.
- Wang, Z., Woolery, E.W., Shi, B., and Harik, I.E., in press, *Seismic Hazard Maps and Time Histories from Earthquakes Affecting Kentucky*, Research Report, Kentucky Transportation Center, University of Kentucky, Lexington, Kentucky.
- USGS, 2006, USGS hazard Map Analysis Tools, Earthquake Probability Mapping (2002): United States Geological Survey, web page, URL <http://earthquake.usgs.gov/research/hazmaps/interactive/index.php>, visited 21-Apr-2006.

1.1.5. Floodplain.

One hundred and forty-six acres of the proposed site lie out of the 500-year floodplain.

The FEMA floodplain map indicates that the proposed FutureGen site lies within the combined Ohio River and Green River floodplains. The 100-year flood elevation at the site is 386 feet above mean sea level (amsl) and the 500-year flood elevation is 390 feet (amsl). Because the site has been modified by surface mining since the creation of the topographic quadrangle map and the FEMA floodplain map, a recent site topographic survey was used to identify the floodplain boundary. The floodplain information was obtained from FEMA flood maps of the Henderson County, with published date of Feb. 6, 1991. The site encompasses two panels, #210286 0150B and #210286 0200B.

The 500-year floodplain elevation is indicated by highlighting the 390 feet contour on the recent site survey. Additionally, during surface mining a berm or levee was constructed along the Green River at an elevation between approximately 385 and 388. Raising this levee to 386 feet can effectively take the entire site out of the 100-year floodplain.



Aerial Photo with Topographical included in Appendix 1.1.5

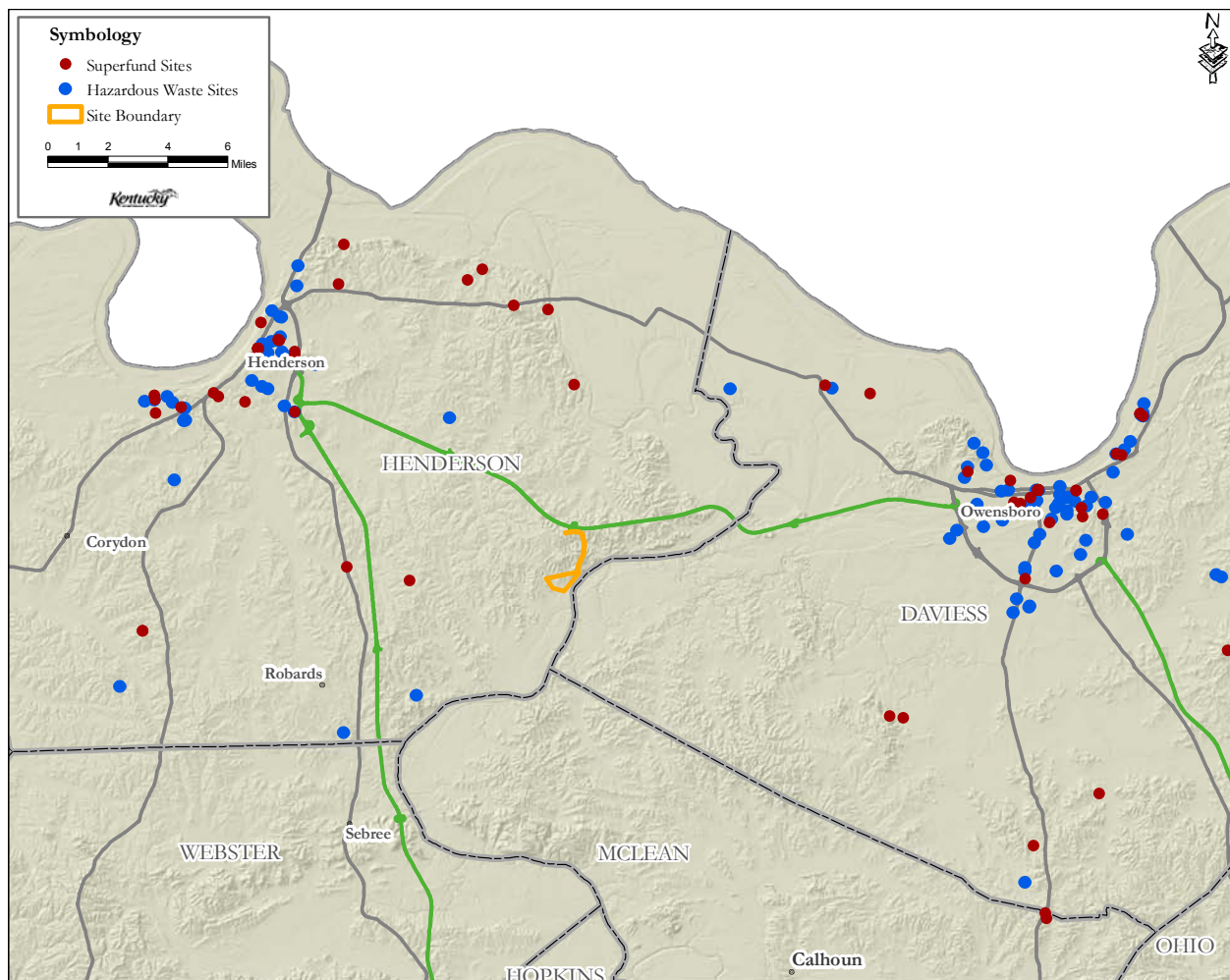
1.2. Other Site Characteristics.

1.2.1. Existing Site Hazards.

The proposed site is a reclaimed surface coal mine with no existing site hazards as defined in the RFP. The site has not been listed on the National Priority List, nor has it generated, treated, stored, or disposed of hazardous wastes identified or listed pursuant to Section 3001 or the Resource Conservation and Recovery Act (RCRA) (42 USC § 6921). It has not been remediated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or the state equivalent (See Appendix 1.2.1 - KRS 224.01-400 and KRS 224.01-405). The property has been bond-released, or will be, and does not have any known hazardous materials. The map below shows Superfund and hazardous waste sites.

The map below shows all Superfund Facility Groups and projects with Superfund Facility Groups that have a latitude/longitude coordinates in TEMPO (red dots).

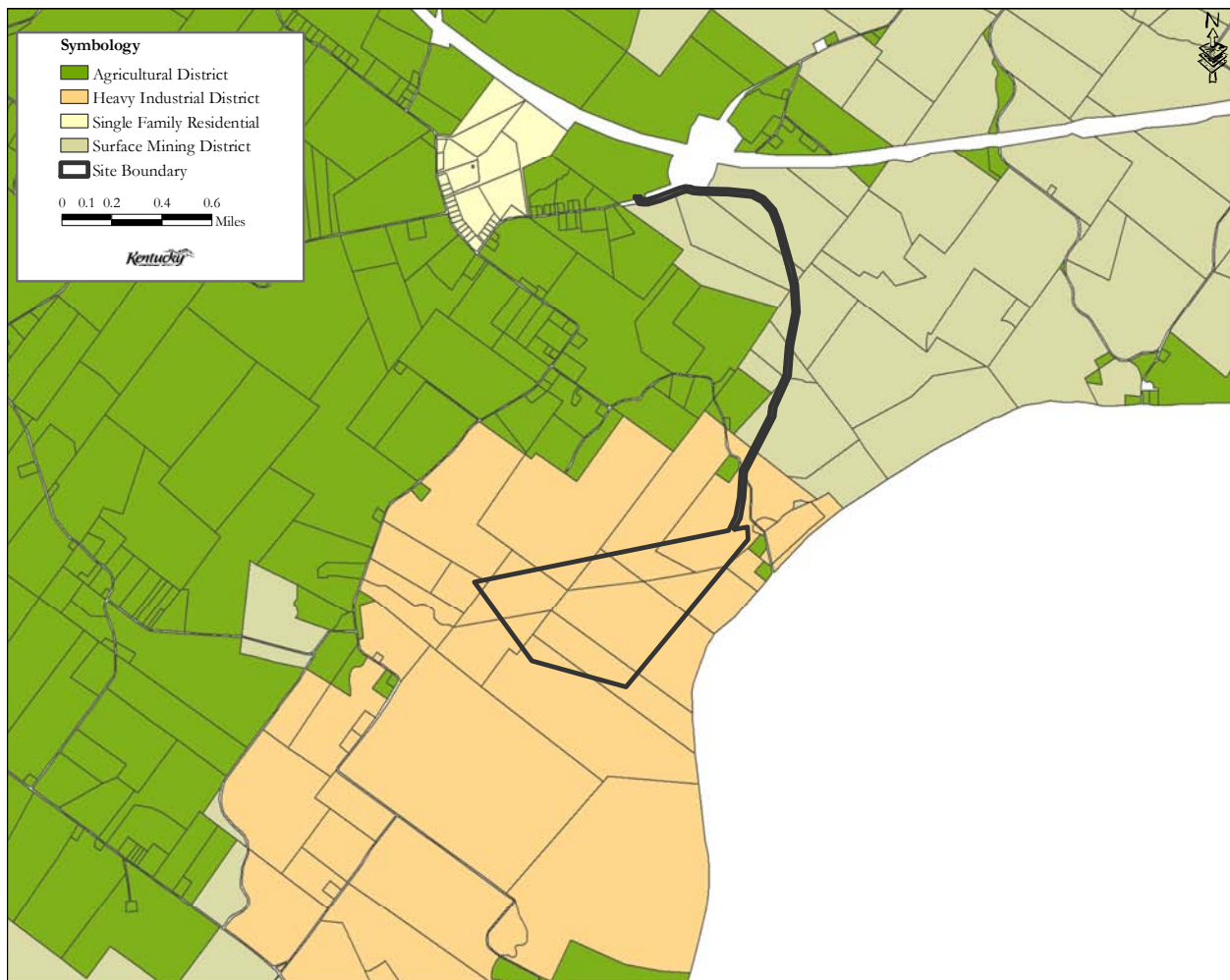
An independent site investigation was also conducted to verify on the ground that the site was free of site hazards (see Appendix 1.2.1 - ECSI letter).



1.2.2. Existing Land Use.

The proposed 215 acre site is part of a comprehensive 1,923 acre site that was rezoned to M-2 Heavy Industrial, which permits power plants in this zone. The existing land uses for the FutureGen site currently consists of agricultural and surface mining uses. These uses are compatible and consistent with the construction and operation of the FutureGen facility. The Henderson County Fiscal Court approved the rezoning of the site from Agricultural and Surface Mining Zoning Classifications to the M-2 Heavy Industrial Classification at its October 16, 2001 meeting. The map indicates the zoning for the site and its surrounding areas. The area adjacent remains zoned for surface mining.

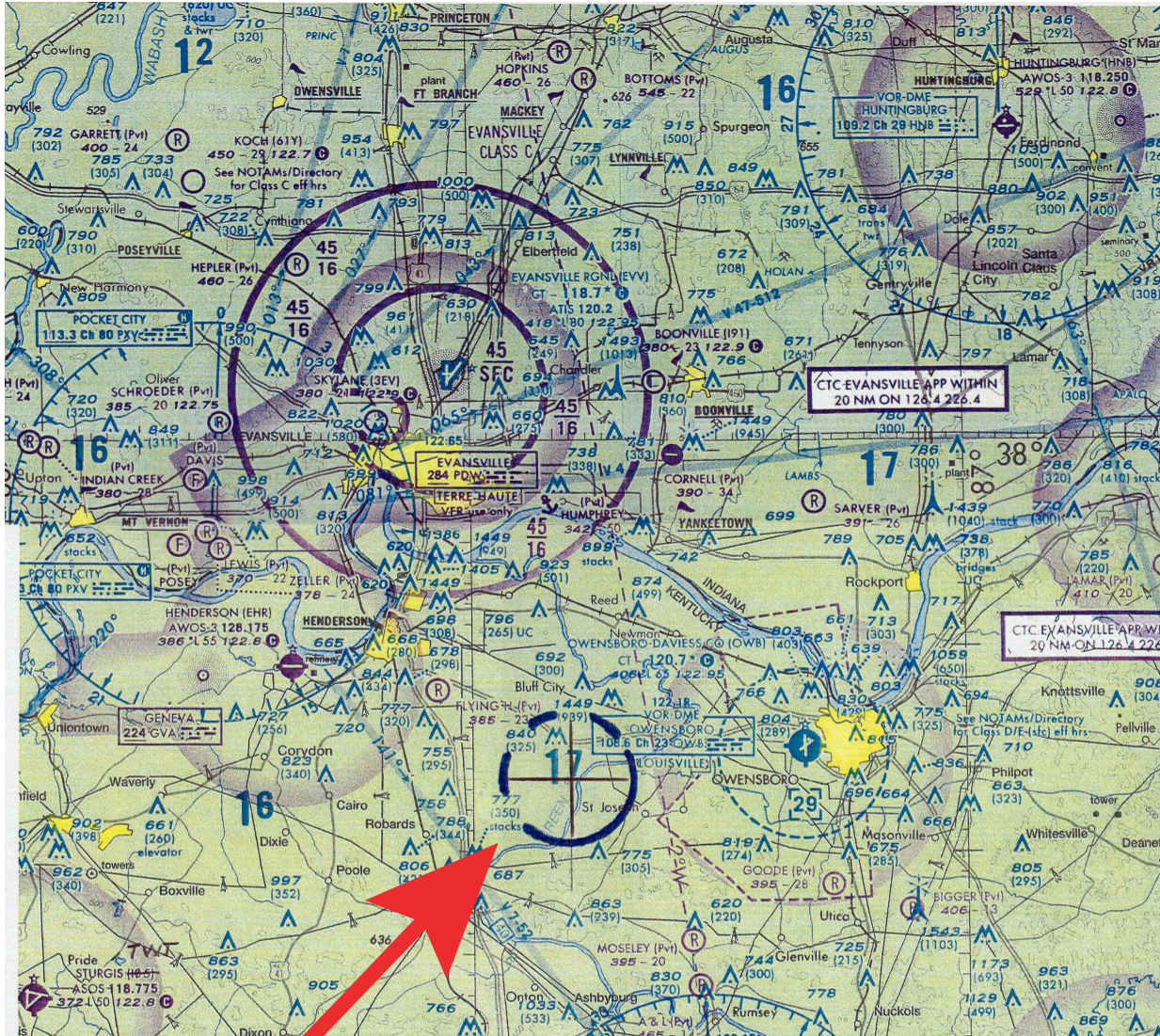
Local Zoning Map for Henderson County, Kentucky



1.3. Proximity to Sensitive Areas.

1.3.1. Restricted Air Space.

According to the Kentucky Airport Zoning Commission and the FAA Sectional Chart below, the proposed FutureGen site is compatible with existing military restricted use airspace.



Site Location

1.3.2. Controlled Air Space.

Assuming a 250-foot maximum height stack, the proposed FutureGen power plant will not exceed any of the state standards which have been adopted by the Kentucky Airport Zoning Commission from the Federal Aviation Administration FAR Part 77.



Kentucky Airport Zoning Commission
200 Mero Street, W3-09-02
Frankfort, Kentucky 40622

TEL - 502-564-4480
FAX - 502-564-7953

April 12, 2006

Office of Energy Policy
Attention: Talina Mathews
12th Floor, Capital Plaza Towers
Frankfort, KY 40622

RE: Aeronautical impact study of Proposed Plant near Euterpe KY, Henderson County

Dear Ms. Mathews:

The proposed site is located 11.5 nautical miles west of the Owensboro Airport (OWB) and 15 nautical miles southeast of the Henderson Airport (EHR). See enclosed sectional chart for site location. The maximum height of the structure is proposed at 250 feet above ground level. This proposal does not exceed any of the state standards. The following are state standards that are adopted by the Kentucky Airport Zoning Commission from the Federal Aviation Administration FAR Part 77. This study is not a permit from the Kentucky Airport Zoning Commission. For a permit applications please visit our website at www.transportation.ky.gov/aviation.

602 KAR 50:070. Standards for determining obstructions.

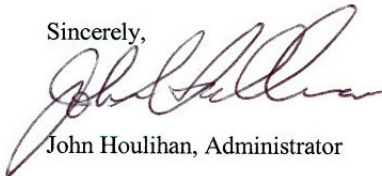
RELATES TO: KRS 183.868, 14 C.F.R. Part 77

Section 1. Standards for Determining Obstructions. A permanent or temporary object shall be an obstruction to air navigation if it is of greater height than any of the following heights or penetrates any of the following surfaces:

- (1) A height of more than 500 feet above ground level at the site of the object.
- (2)(a) A height that is more than 200 feet above ground level or above the established airport elevation, whichever is higher, within three (3) nautical miles of the established reference point of a public use and military airports, which has at least one (1) runway of more than 3,200 feet in actual length.
- (b) Beyond three (3) nautical miles, that height increases in the proportion of 100 feet for each additional nautical mile of distance from the airport reference point up to a maximum of 500 feet.

If you have any questions, please let me know.

Sincerely,



John Houlihan, Administrator

Enclosure

1.3.3. Cultural Resources.

There are no documented occurrences of cultural, historical, or archaeological resources or Traditional Cultural Properties on or within one mile of the proposed power plant site boundary or any new transmission line, transportation or pipeline corridor.

The transmission corridors will utilize existing rights of way to the extent possible. The proposed access road and proposed pipeline corridor are in areas presently part of an active mine or have been mined and would contain no such resources or properties.



COMMERCE CABINET
KENTUCKY HERITAGE COUNCIL

Ernie Fletcher
Governor

The State Historic Preservation Office
300 Washington Street
Frankfort, Kentucky 40601
Phone (502) 564-7005
Fax (502) 564-5820
www.kentucky.gov

George Ward
Secretary

David L. Morgan
Executive Director and
State Historic Preservation Officer

March 30, 2006

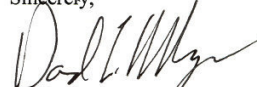
Mr. Andrew V. McNeill
Acting Executive Director
Office of Energy Policy
Capital Plaza Tower, 12th Floor
500 Mero Street
Frankfort, KY 40601

Dear Mr. McNeill:

Thank you for your letter of March 22, 2006 concerning a possible site for the FutureGen project. This project will be a joint effort between the U. S. Department of Energy and the Industrial Alliance to construct and operate a zero-emissions coal-fired electricity generating facility. The principal site being considered is located in southeastern Henderson County, Kentucky adjacent to the Green River. Your letter indicates that the proposed project area was part of a larger coal mining area that has been reclaimed. A review of our files indicates that the project was subjected to archaeological surveys in 1986 and that one significant archaeological site was mitigated in 1988. Further, there are no recorded structures within the area of direct impact. Consequently, the proposed FutureGen project will have no effect on any property currently listed in or eligible for listing in the National Register of Historic Places. In accordance with 36CFR Part 800.4 (d) of the Advisory Council's revised regulations our finding is that there are No Historic Properties Present within the undertaking's area of potential impact. Therefore, we have no further comments and the Agency Official's responsibility to consult with the State Historic Preservation Officer under the Section 106 review process is fulfilled.

Should you have any questions, feel free to contact Charles Hockensmith of my staff at (502) 564-7005.

Sincerely,



David L. Morgan, Director
Kentucky Heritage Council and
State Historic Preservation Officer



KentuckyUnbridledSpirit.com

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1.3.4. Threatened and Endangered Species (TES) and Critical Habitat.

According to the U.S. Department of Interior, Fish and Wildlife Service, there are no known federally-listed endangered or threatened species or critical habitats on the site.



United States Department of the Interior

FISH AND WILDLIFE SERVICE
3761 Georgetown Road
Frankfort, Kentucky 40601

April 18, 2006

Ms. Talina Matthews
Kentucky Office of Energy Policy
12th Floor, Capital Plaza Tower
500 Mero Street
Frankfort, Kentucky 40601

Subject: FWS 06-0784; Species Information Request for Property in Henderson County, Kentucky

Dear Ms. Matthews:

We received your email requesting information on the presence of threatened and endangered species and/or federally designated critical habitat at a specific property in Henderson County, Kentucky. According to your email, the subject property would be used to construct a zero emission coal fired power plant. Fish and Wildlife Service (Service) personnel have reviewed the information submitted, and we offer the following comments.

Endangered species collection records available to the Service do not indicate that federally listed or proposed endangered or threatened species occur within the specific property you have identified in Henderson County. Also, no critical habitat has been designated to include the specific property. We note, however, that the collection records available to us may not be all-inclusive. Our database is a compilation of collection records made available by various individuals and resource agencies. This information is seldom based on comprehensive surveys of all potential habitat and thus does not necessarily provide conclusive evidence that protected species are present or absent at a specific locality.

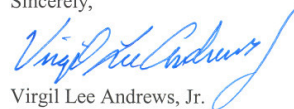
Although we do not have specific occurrence records for the specific parcel, our records do indicate that a number of federally listed species are known to occur in Henderson County. These species, listed below, could occur on the project site if suitable habitat is present:

<u>Common Name</u>	<u>Scientific Name</u>	<u>Federal Status</u>
Bald eagle	<i>Haliaeetus leucocephalus</i>	threatened
Indiana bat	<i>Myotis sodalis</i>	endangered
Fanshell	<i>Cyprogenia stegaria</i>	endangered
Ring pink	<i>Obovaria retusa</i>	endangered
Pink mucket	<i>Lampsilis abrupta</i>	endangered
Fat pocketbook	<i>Potamilus capax</i>	endangered
Catspaw	<i>Epioblasma obliquata obliquata</i>	endangered
American burying beetle	<i>Nicrophorus americanus</i>	endangered

If this specific property is chosen for the construction of the power plant, we look forward to providing further comments regarding project construction activities pursuant to section 7 of the Endangered Species Act. Please be aware that this letter does not provide clearance from the Service for the project to proceed. This letter is only meant to provide information regarding known occurrences of threatened and endangered species and critical habitat within the subject property and Henderson County, Kentucky.

Thank you for the opportunity to comment on this proposed action. If you have any questions regarding the information that we have provided, please contact Mindi Lawson at (502) 695-0468 (ext. 229).

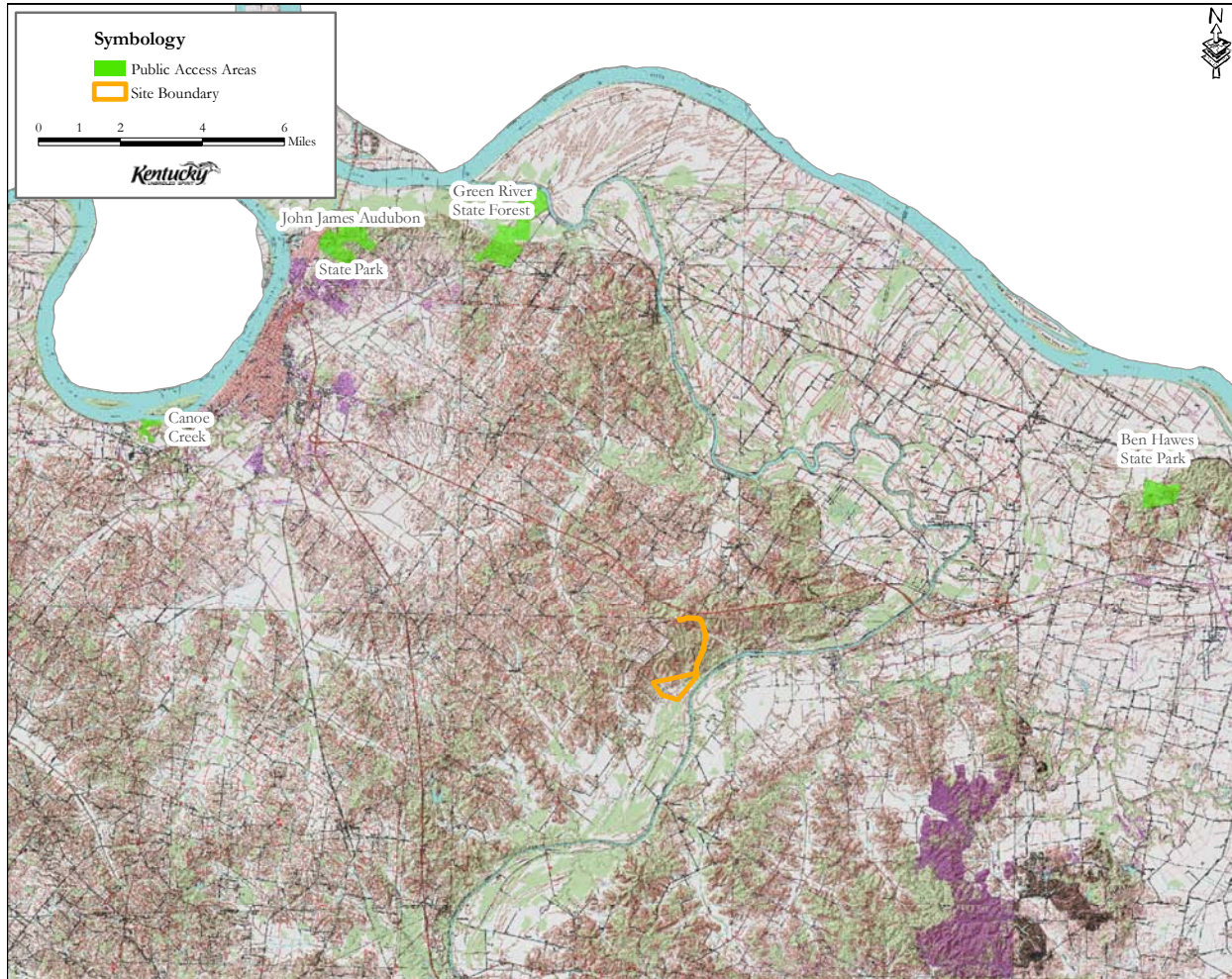
Sincerely,



Virgil Lee Andrews, Jr.
Field Supervisor

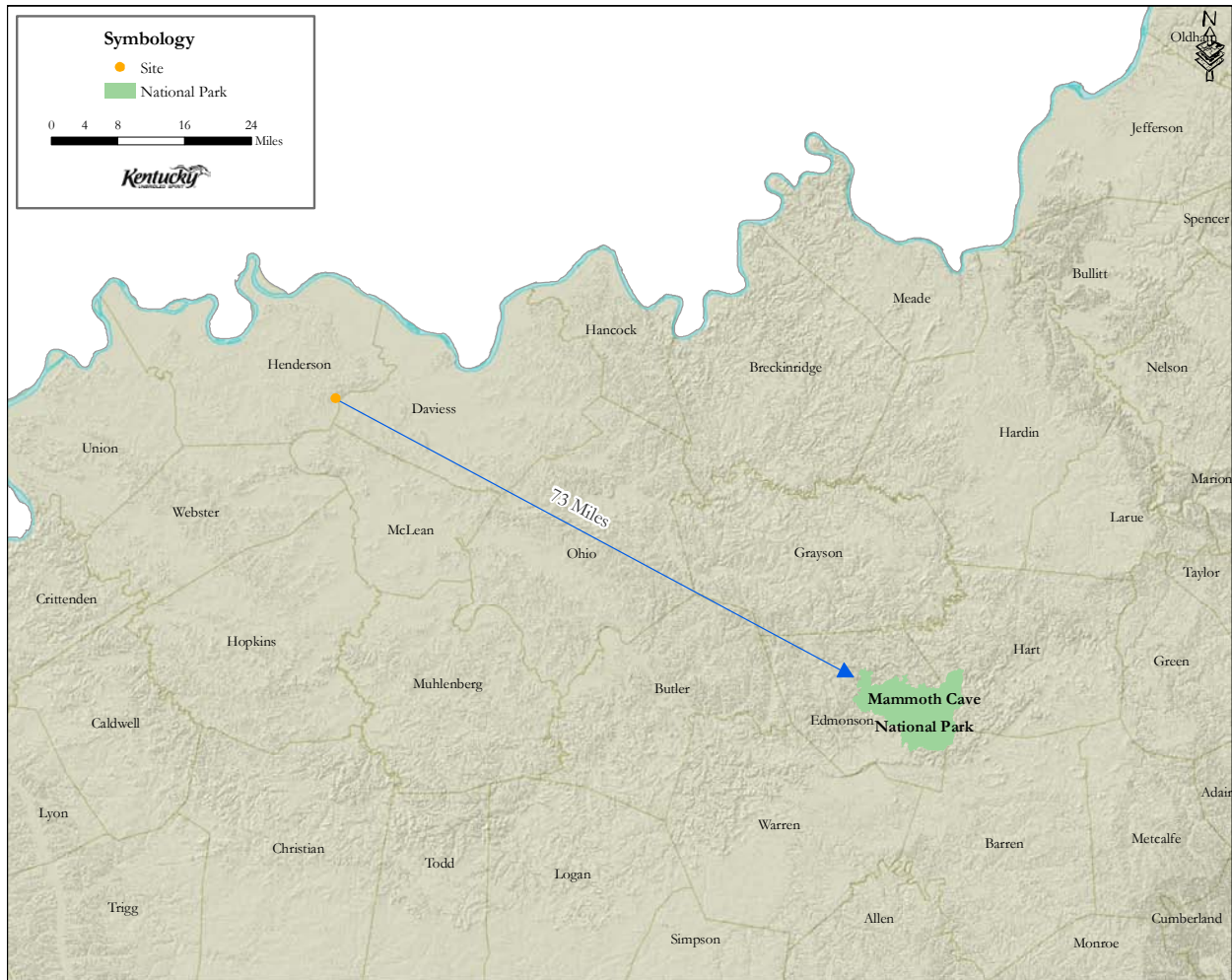
1.3.5. Proximity to Public Access Areas.

The map below illustrates the PAA areas in the vicinity of the proposed FutureGen site of which the closest, the Green River State Forest, is approximately 11 miles from the proposed FutureGen site.



1.3.6. Proximity to Class I Visibility Areas.

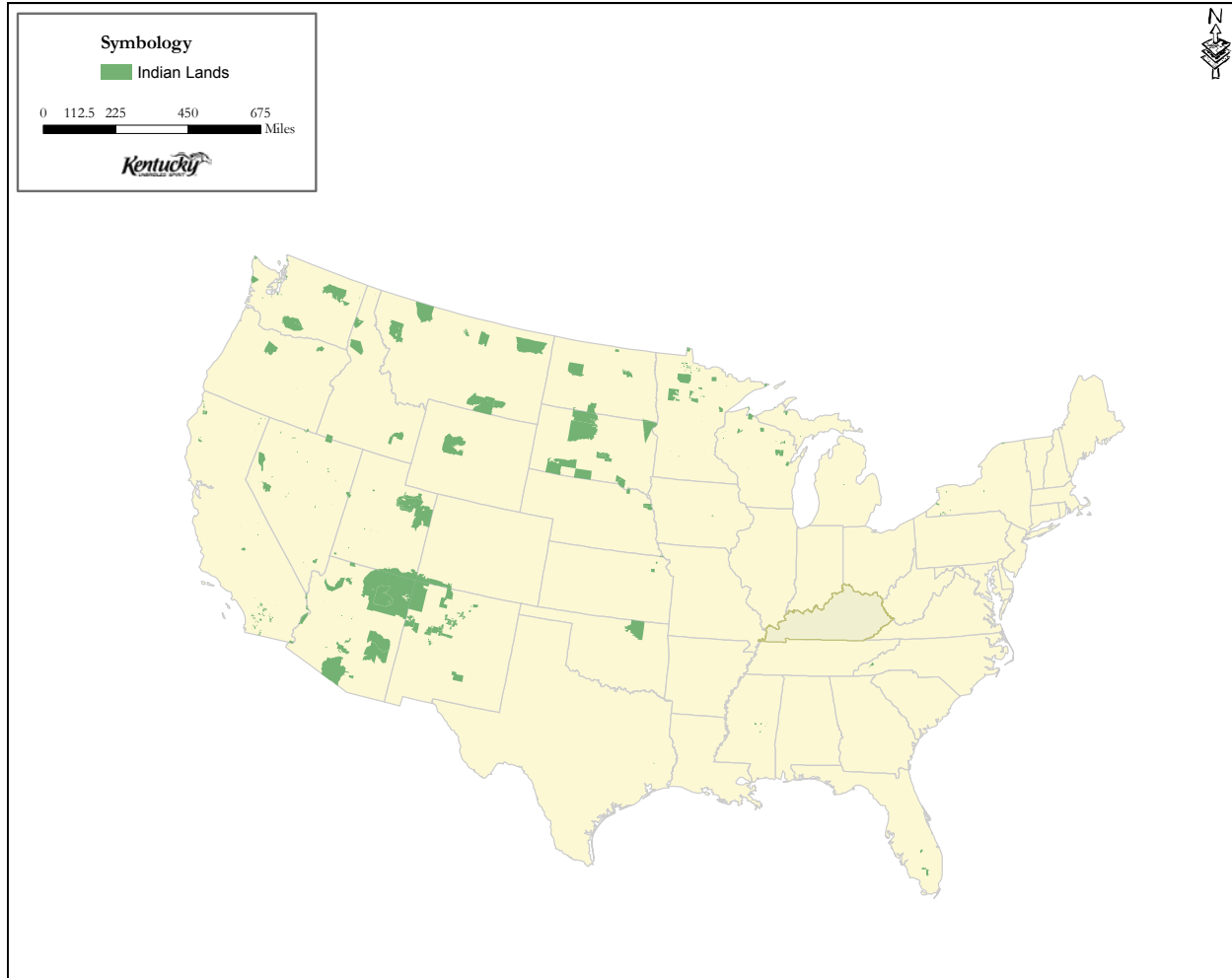
There are no Class I Visibility Areas within 60 miles of the proposed site. The closest Class I Area is Mammoth Cave National Park, located approximately 73 miles (115 km) from the site.



1.3.7. Proximity to Tribal Lands.

According to the Bureau of Indian Affairs, Department of the Interior, there are no tribal lands located in Kentucky.

National Map of Federally Recognized Tribes and EPA Regions



Source: U.S. Environmental Protection Agency website, American Indian Environmental Office section (<http://www.epa.gov/indian/map.htm>).

1.4. Cooling Water.

1.4.1. Access to Cooling Water.

The Green River, located adjacent to the site, can serve as the water source for the cooling water. Because of the volume of water available from the Green River, no other source of cooling water is necessary.

The Green River forms the second largest river basin in Kentucky with a total drainage area of 9,230 square miles. The proposed site drains approximately 8,700 square miles and produces an annual average flow of nearly 8-billion gallons of water per day.

Because the water source is the Green River, there is no public service provider as specified in the Alliance RFP. Waters of the Commonwealth are subject to a system of permitting whereby a responsible person with a need for water for a useful purpose may obtain a permit to withdraw and use public waters (See 1.4.1 Appendix - KRS 151.140 and 401 KAR 4:010). These permits represent a limited right of use and do not vest ownership, or an absolute right to withdraw or use water, and there are not created rights that can be purchased or waived, either for surface water or groundwater. Kentucky law (KRS 151.120) does not assign absolute rights to the use of a water source but rather are available for use through permitting.

The proposed use of the Green River will be subject to Kentucky water withdrawal permitting regulations (See 1.4.1 Appendix - 401 KAR 4:010). Standard criteria for a water withdrawal permit for the proposed site could allocate up to 185 million gallons per day (185 MGD) to a single user. A continuous withdrawal of 2,500 gallons per minute (3.6 MGD) for the FutureGen plant represents a minor allocation in this reach of the river and, as such, would be permitted with no conditions to limit withdrawals during periods of low flow.

1.4.2. Adequacy under Low Flow Conditions.

Withdrawal requirements for the FutureGen plant represent a minor allocation during drought conditions of this reach of the river and, as such, would be permitted with no conditions to limit withdrawals during low flow. The Green River is capable of supplying plant makeup requirements under the most extreme recorded drought conditions encountered in the basin.

Flow in the Green River is regulated by the activities of four (4) U.S. Army Corps of Engineer (USACE) reservoirs in the basin. Prior to flow regulation, the 7Q10 at the proposed site was approximately 400 cubic feet per second (258 MGD). Since 1969 when the fourth USACE reservoir came online, the 7Q10 has risen to nearly 500 cubic feet per second (323 MGD). A proposed use rate of 2,500 gallons per minute (3.6MGD) will consume slightly more than one (1) percent of the river flow under 7Q10 low flow conditions.

A review of historical drought periods in both the pre- and post-regulation years identified five (5) occurrences of severely low flow conditions in Green River. The duration of the low flow period and the mean flow for each period is presented in the following table:

Comparison of Proposed Water Usage Rate to Historic Low Flow

Historical Low Flow Periods	Low Flow Duration (days)	Mean Low Flow (MGD)	Proposed Use Rate (percent of mean low flow)
1930	46	234	1.5%
1940-1941	88	290	1.2%
1953-1954	92	227	1.6%
1988	24	256	1.4%
1999	48	185	1.9%

1.5. Material and Fuel Delivery.

1.5.1. Coal Supply Environment.

The Kentucky FutureGen site has very cost-competitive access to alternate sources of bituminous and sub-bituminous coals through numerous alternative transportation modes. Its location near the center of the bituminous coal-producing areas of West Kentucky, Indiana, and Illinois gives access to a demonstrated reserve base of 133.6 billion tons and at-the-mine recoverable reserves of 1.5 billion tons and annual production from 70 mines of over 90 million tons. The Kentucky site also has cost-competitive access to bituminous coals from Central Appalachia and the Western U.S, and to Powder River Basin sub-bituminous coal. Anthracite and lignite are not included in this coal source survey, however, could utilize barge or rail to truck.

Illinois Basin coals range from 10,500 – 11,800 Btu/lb and from 1.4% - 3.2% sulfur. Marker prices range from \$27.00 to \$44.75/ton FOB transport; higher sulfur coals range from \$27.00 to \$32.00.¹ Delivery to the Kentucky site is by conveyor belt from the adjacent mine, by barge on the Green River or by truck.² Truck rates are \$0.10 per ton per loaded mile. Within a 60-mile radius that includes all of West Kentucky production, most Indiana production, and a large part of Illinois production, shipping costs to the Kentucky site would be similar. Coal can be trucked from mines adjacent to or near the Kentucky site at nominal cost. In West Kentucky, 18 river terminals are open to any shipper and 7 are captive; there are 17 terminals in Indiana and Illinois. Barge rates are typically less than rail rates.

River terminals on the Ohio and the Big Sandy give access to 2.3 billion tons of at-the-mine recoverable reserves in Eastern Kentucky, Southern West Virginia, and Ohio and annual production from 661 mines in the area of over 221 million tons. The marker price for Central Appalachian 12,000 Btu, 1% sulfur, coal is \$52.50 FOB barge, Big Sandy/ Ohio River. There are 15 river terminals in the Big Sandy/Ohio area within short rail or truck haulage from mines in the three states. Barge from the Big Sandy/ Ohio to the Kentucky site is \$6.30/ton, including loading and unloading.

Rail to river transport gives access to at-the-mine reserves of Colorado bituminous and PRB coals of 415 million tons and 7.1 billion tons, respectively and annual production from 28 mines of 31.5 million tons bituminous and 396.5 million tons sub-bituminous, respectively. An FOB rail marker price for 11,000 Btu, 0.44% sulfur, Colorado bituminous coal is \$36.00/ton. An FOB rail marker price for 8,400 Btu, 0.34% sulfur, Wyoming PRB coal is \$11.40/ton. Coal can be moved from the two states by rail for \$18.00 - \$20.00 per ton to a public river terminal in Southern Indiana and transferred to barge, completing the trip for an additional \$4.00 – \$5.50, including handling. Both the Colorado and the Wyoming coal can be moved by rail to St. Louis and transloaded to barge for the remainder of the trip to the Kentucky site at a savings of \$0.25 to \$0.50 per ton. For a similar cost, the Colorado and Wyoming coals can be transported via rail to the P&L Railroad in West Kentucky with transfer for barge delivery in West Kentucky. Western coals are already being shipped into Western Kentucky from blending.

¹All price quotations are from Platt's Coal Outlook, April 17, 2006.

²Barge and truck haulage rates are from telephone surveys of industry for this report.

PART 2--Geologic Storage Qualifying Criteria

2.1. Surface Characteristics.

2.1.1. Location.

The proposed FutureGen site is located in southeast Henderson County, on the Delaware 7.5-minute topographic quadrangle. The site is on the Green River, a navigable tributary of the Ohio River. The site lies in the Western Kentucky Coal Field, a major coal-producing area. It is also in the Western Kentucky portion of the Illinois Basin, a mature oil-producing basin. The proposed carbon sequestration target is present directly below and in the area surrounding the site. While not proposed as a formal sequestration target, mature oil fields immediately adjacent to the site provide ideal opportunities for enhanced oil recovery with CO₂ flooding.

The primary target for carbon sequestration is a porosity zone in dolomites of the Cambro-Ordovician Knox Supergroup (primary saline aquifer) at a depth of 2,249 m (7,380 feet).

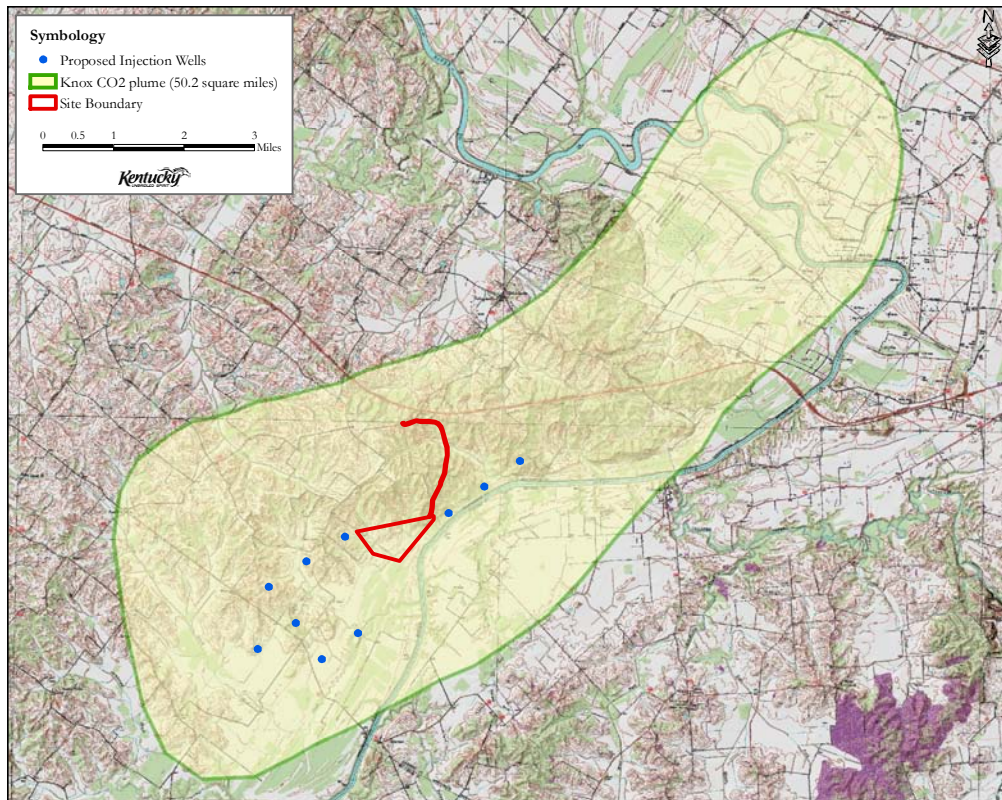
Injection models indicate 10 wells are needed to sequester the required volume of CO₂ in the Knox.

A secondary target is the Devonian New Albany Shale (organic shale) at 1,135 m (3,725 feet).

The Mt. Simon Sandstone is considered a regional saline aquifer in several of the DOE Phase I Re-

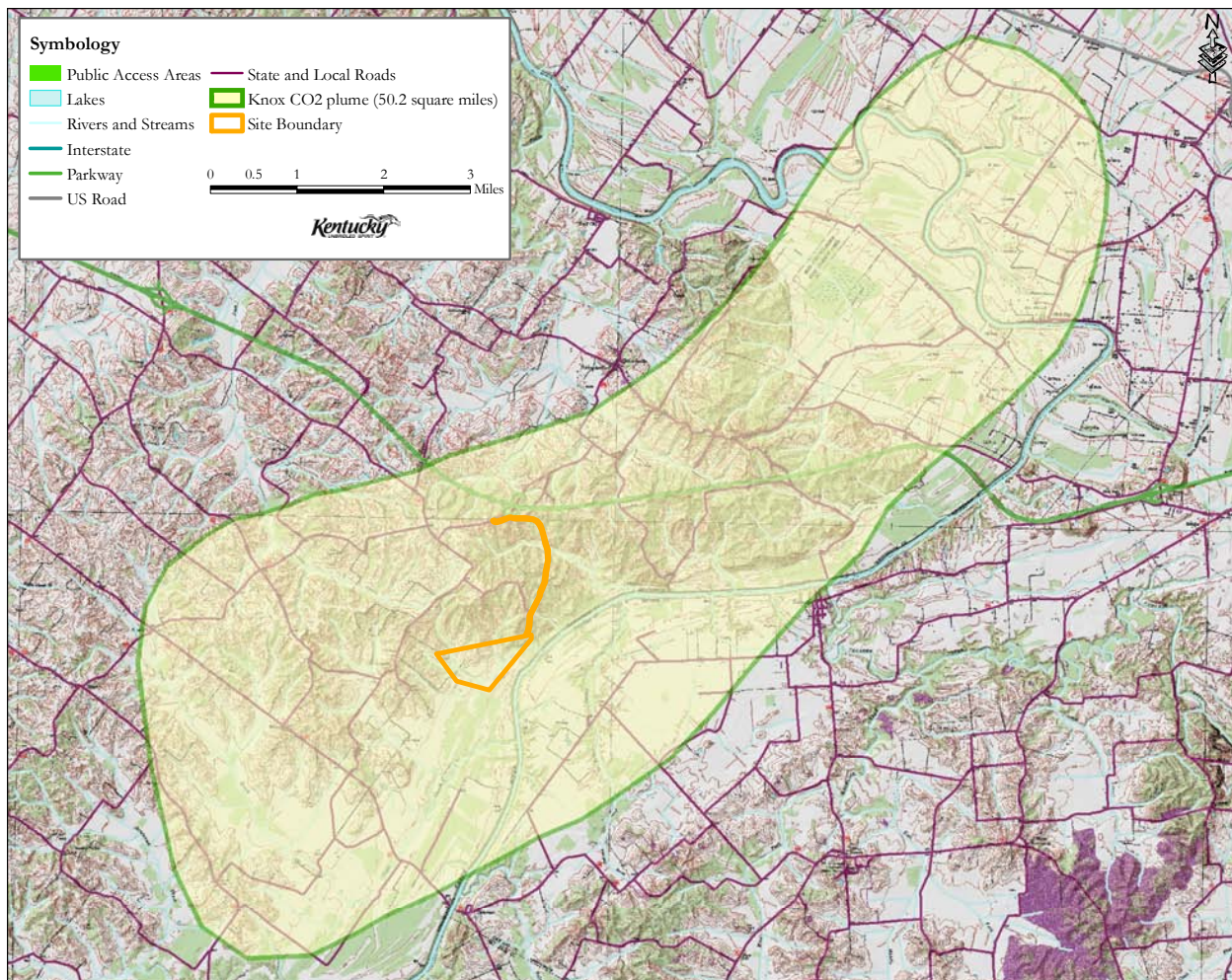
gional Carbon Sequestration Partnerships, and is estimated to be 98 m (320 feet) thick, at a depth of 3,627 m (11,900 feet) beneath the site. The Mt. Simon and other potential zones appropriate for sequestration underlie the site but were not considered formally here because of the paucity of data in the vicinity of the site.

All proposed injection wells are more than 32 km (20 miles) from a U.S. Border.



2.1.2. Access.

More than 60% of the plume area is physically accessible for installation of monitoring equipment. The majority of the plume area has been identified as being controlled by Penn Virginia which has signed an MOU with the Commonwealth of Kentucky (see 2.1.2 Appendix - Penn VA MOU). Five hundred and eighty-five private, one federal, one state and one local government landowner, including 375 residences were identified above the 50(+) square mile plume area according to the Kentucky Department of Revenue. Other access restrictions include the Green River, Audubon Parkway and state and local roads. There are no major towns within the proposed plume area. This area is predominantly agricultural, unmanaged forest, and surface mining operations. The plume area is sparsely populated and generally owned in large tracts or controlled by mining leases. A limited area associated with the adjacent mine facilities will impact access.



2.2. Subsurface Site Characteristics.

2.2.1. Mineral Rights.

The Commonwealth of Kentucky has a long history of natural resource development for many large-scale projects; including coal, natural gas, oil, aggregates, and natural gas storage fields. The Commonwealth of Kentucky has also demonstrated in past years its ability to bring large-scale economic development projects to this state. In recent years this has been witnessed by the Toyota Motor Manufacturing of Kentucky (TMMK) in Georgetown, Kentucky. There are many other projects of a similar nature that are analogous to the FutureGen site development.

Near the FutureGen site are large-scale operations of Peabody Energy subsidiaries, both underground mines (approximately 6,000 acres) and surface mines (approximately 6,000 acres), with overland conveyors and preparation plants and barge load-out facilities. This private development, which bridges many surface and underground property owners, shows how projects of this nature are easily put together and coordinated. Also the oil and gas operations in the area show the co-existence of underground coal rights and the overlapping oil and gas rights and the ability of those two operations to co-exist. These locations also provide the ability to easily drill through these barrier zones to provide additional injection and monitoring wells. Cooperation between the various owners for this purpose can be demonstrated from both a technical and legal standpoint to provide the right-of-entry for these purposes.

The Commonwealth has recently executed an MOU with Penn Virginia Operating Company, LLC, who owns the majority of the mineral rights in the plume area. This MOU is a commitment of the parties to negotiate access to the target formations. Penn Virginia owns approximately 16,000 of the 18,000 acres the Kentucky Department of Revenue has identified within the projected plume area. See 2.2.1 Appendix for documentation. Further, the right to condemn property rights, privileges or easements exists within the Commonwealth of Kentucky under the authority of KRS 416.540 et seq (see 2.2.1 Appendix).

2.2.2. Water Rights.

Kentucky law (KRS 151.120) does not assign absolute rights to the use of a water source but rather are available for use through permitting.

Waters of the Commonwealth are subject to a system of permitting whereby a responsible person with a need for water for a useful purpose may obtain a permit to withdraw and use public waters (KRS 151.140 and 401 KAR 4:010). These permits represent a limited right of use and do not vest ownership, or an absolute right to withdraw or use water, and there are not created rights that can be purchased or waived, either for surface water or groundwater.

KRS 151.120 states that "Water occurring in any stream, lake, ground water, subterranean water or other body of water in the Commonwealth which may be applied to any useful and beneficial purpose is hereby declared to be a natural resource and public water of the Commonwealth and subject to control or regulation for the public welfare."

The two statutes and one regulation referenced above can be found in 2.2.2 Appendices.

2.3. Drinking Water.

2.3.1. Total Dissolved Solids or Maximum Concentration Levels.

The Kentucky Division of Water, the Kentucky Division of Oil and Gas Conservation, the Kentucky Geological Survey, and U.S. EPA Region IV Underground Injection Control staff agree the target formation is not a current or potential underground source of drinking water (USDW) because the formation waters are anticipated to exceed 10,000 mg/L of total dissolved solids (TDS).

The proposed target formation for injection is the Cambro-Ordovician Knox Supergroup. The formation is considerably deeper than any USDW in this area of Kentucky. Local seismic data indicate the drilling depth to the top of the saline aquifer in the Knox is approximately 2,249 m (7,380 feet) and is an estimated 9816.5 m (32054 feet) thick.

Analysis of a water sample from an aquifer zone in the Dupont waste disposal well in Jefferson County, Kentucky at a depth of 5,408-6,008 feet (shallower than the target zone in Henderson County) indicates 207,000 mg/l TDS.

The Fresh-Saline Water Interface Map of Kentucky (Hopkins, 1966, see 2.3.1 Appendix) indicates water from a well proximal to the site drilled to 507 feet total depth had a TDS of >2,600 mg/L, and a chloride level exceeding 600 mg/L. The base of the lowermost USDW's in this area occur in the 700 to 800 feet depth range. Regionally, oil and gas wells producing at depths ranging from 1,000 to 3,000 feet produce brines up to 34,000 mg/L that exceed the 10,000 mg/L TDS limit for a USDW. There is no likelihood that the target formation would qualify as a USDW.

Reference:

Hopkins, H.T., 1966, Fresh-saline water interface map of Kentucky: United States Geological Survey/Kentucky Geological Survey Hydrogeologic Map 21, scale 1:500,000, with text.

2.3.2. Water Resource Usage.

The proposed facility will not have an impact on current or future sources of drinking water. Local public drinking water sources utilize surface water and shallow aquifer systems. There are no private wells proximal (within a 2-mile radius) to the proposed site and the private wells in the region are generally shallow (<300 feet in depth).

Public water systems in Daviess, Henderson, and McLean Counties, Kentucky include Owensboro Municipal Utilities (Daviess), Henderson Municipal Utilities (Henderson), Henderson Utilities/South (Henderson), Sacramento Water (McLean), Livermore Water (McLean), Calhoun Water (McLean), Alcan Ingot Sebree Aluminum (Henderson), Trocadero Plaza (Henderson), and Ellis Park Race Course (Henderson). Owensboro Municipal Utilities' plant is located near the Ohio River in Henderson County. The Owensboro well field is approximately 18 miles east of the FutureGen site along the Ohio River. Owensboro is the largest regional drinking water supplier in the three-county area. The public water system's two plants have a combined capacity of 30 million gallons per day (MGD) but currently produce 13 MGD. Raw water is withdrawn for treatment from a well field of 34 wells located in the valley fill aquifer (Ohio River Alluvium) along the Ohio River.

Wells range in depth from 112 feet to a maximum depth of 147 feet. Owensboro has utilized the current well field since the 1940's. Drinking water usage needs for the next ten years will continue to be provided by the Ohio River alluvium well field. Trocadero Plaza is a non-community drinking water system in Henderson County. It utilizes a ground water source; the well is 57 feet deep. The public water system plans to connect the Henderson Municipal Utilities when the extension of waterlines to that area is completed.

Ellis Park Race Course is a non-community public water system in Henderson County. It utilizes a ground water source. The site utilizes one well for public drinking water. The well is drilled to a depth of 90 feet. A second well exists for redundancy for the drinking water supply, but this well has never been used. Two other wells on site are used for watering the racetrack. All wells at this site are located in the Ohio River alluvium and are less than 150 feet in depth.

All other drinking water systems in the three county area utilize surface water sources, primarily the Ohio River and the Green River. No drinking water intakes on the Green River exist below the proposed FutureGen site. The nearest drinking water intake is approximately 40 miles downstream on the Ohio River at Evansville, Indiana.

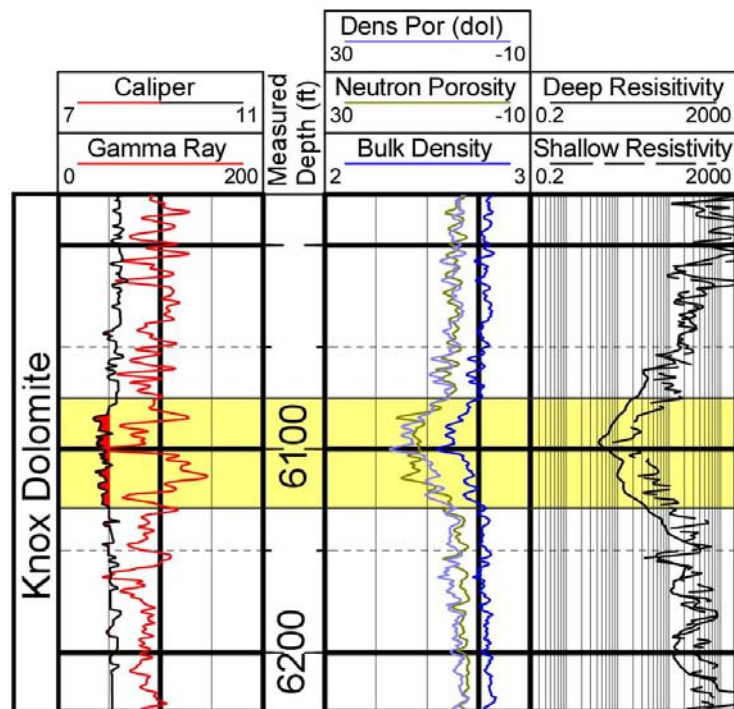
2.4. Formation Properties.

2.4.1. Deep Saline Formation.

The primary injection target for the Henderson County site is the Cambro-Ordovician Knox Supergroup, a deep saline formation. Calculations in section 2.5.1 show that the Knox is capable of meeting 100% of the CO₂ injectivity and capacity requirements.

A secondary target is discussed in section 4. The Knox is a regionally extensive and thick dolomite, with well-developed porosity zones common throughout the state. Kentucky's only waste injection wells are in the Knox. The Dupont wells in Jefferson County (148 km, 92 miles from site) injected into vuggy Knox porosity zones, at depths of 960 to 1,006 m (3,150 to 3,300 feet). The IMCO Recycling well in Butler County (82 km, 51 miles from site) injects into a Knox vuggy porosity zone, at a depth of 1,966 m (6,450 feet). Two gas storage fields are also located in the Knox. The Eagle Creek Gas Storage Field of Grant County is at a depth of 247 to 324 m to (812 to 1,064 feet) and the Ballardsville Field of Oldham County (abandoned) is at 383 m (1,255 feet). Both fields are in vuggy porosity reservoirs in the upper part of the unit. Knox carbonates are also prolific hydrocarbon producers on the Cincinnati Arch, 161 km (100 miles) to the east.

The Knox porosity zone in the Texas Gas 1A Kerrick well (17.7 km, 11 miles away) is 24 m (79 feet) thick, but net porosity feet above 4% is 16.5 m (54 feet). Mean density porosity is 9.3% (range 4 -17%). There is mud cake over the zone on the caliper logs. These conditions indicate permeability. The nearest core with permeability analyses is the Dupont injection well in Louisville. Determinations of horizontal permeability are often measured in 2 orthogonal directions. Large differences in these values are often indicative of fracture-related permeability. Permeability from Knox cores in porosity zones in the Dupont well range from 632 to <1 md, but the average of values with horizontal permeability that are similar in both directions is 60.0 md. This average matrix permeability value was used for the Henderson County site evaluation.

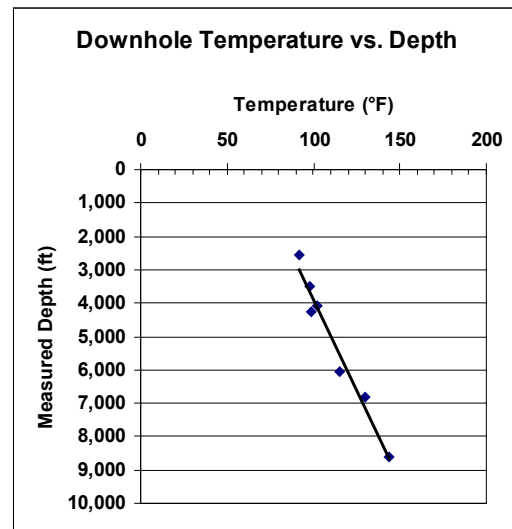


Texas Gas 1A Kerrick: Knox Zone

2.4.2. Depth.

The Cambro-Ordovician Knox Supergroup saline aquifer is at an estimated drilling depth of 2,249 m (7,380 feet) below ground level near the center of the site, well below the critical point of CO₂. Using bottom-hole temperatures and temperature logs in nearby wells, the temperature of the Knox saline aquifer is expected to be 130°F (54°C). Formation pressure of the Knox interval at 2,249 m (7,380 feet) is calculated to be 22.1 megapascals (218 atm) based on 7 drill stem tests in the Knox in the Dupont wells in the basin, which suggest a geopressure gradient of 43.3 psi (3 atm) per 100 feet. This is different than the geopressure gradient of 39.2 psi (2.7 atm) per 100 feet commonly used for shallower fields in the basin.

No drill hole data are available at the site; the following method was used to derive the depth measurement. Depth to the Devonian New Albany Shale was interpolated from a regional structure contour map (Frankie and others, 2000) along five proprietary seismic profiles near the site. Values for the New Albany tops were added to those interpreted from the seismic profiles for the interval from the top of the New Albany to the top of the Knox, both recognizable reflectors in the region. The two-way-travel velocity of 18,500 ft/sec derived for the interval in the Exxon #1 Bell well (19 km, 12 miles to the southwest) was first applied to the same interval in the seismic profiles near the site. Small-scale elevation differences at the New Albany level, however, are not reflected in the top of the Knox, falsely creating a higher relief surface than is shown by the Knox reflector. Therefore, an overall velocity value of 14,000 ft/sec. from surface to the top of Knox was applied that more accurately reflects the depth and more accurately smooths the configuration of the Knox reflector. This velocity was then applied to all available seismic data and the area in the vicinity of the site mapped on the top of the Knox. The map indicates that the site lies at the crest of a northeast-oriented elongate dome. Estimated depth near the center of the site to the top of the Knox is about 1,996 m (6,550 feet) subsea or 2,112 m (6,930 feet) below ground level. The porosity zone in the Knox is an additional 137 m (450 feet) below the top of the Knox based on data from the Texas Gas 1A Kerrick well (17.7 km, 11 miles to the southeast) or at a total depth of 2,249 m (7,380 feet) below the surface at the site.



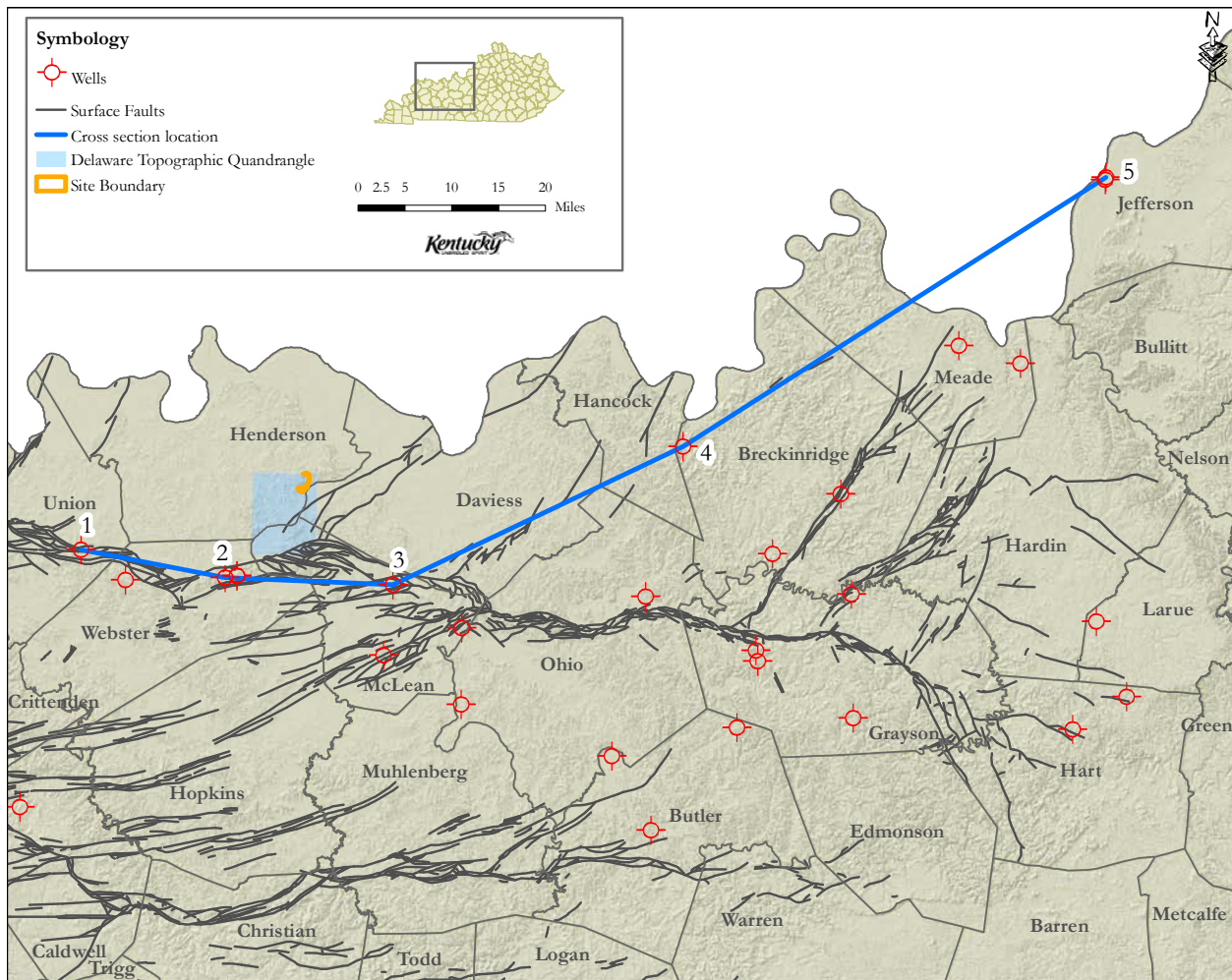
References

Frankie, W.T., Lumm, D.K., Boberg, W.S., Hasenmueller, N.R., Smidchens, Zinta, and Hamilton-Smith, 1994, in Hassenmueller, N.R. and Comer, J.B. eds., Gas Potential of the New Albany Shale (Devonian and Mississippian) in the Illinois Basin: Gas Research Institute,,GRI-92/0391, Illinois Basin Studies 2, 83p.

2.4.3. Formation Stimulation.

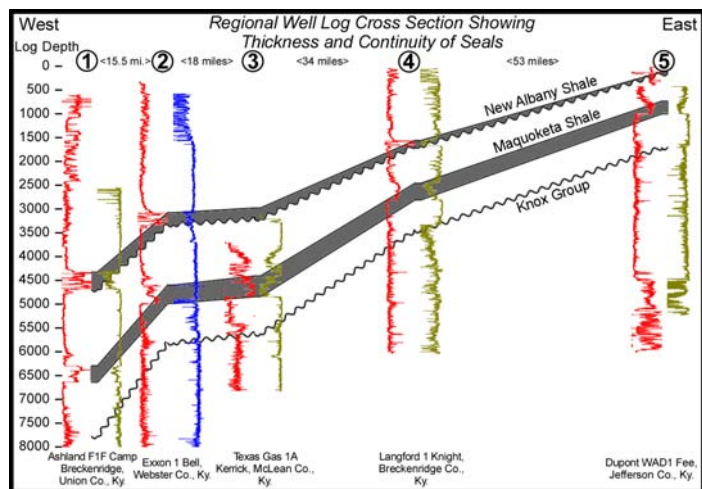
The primary injection target in the Cambro-Ordovician Knox Supergroup is proposed to be completed using vertical wells without hydraulic fracture stimulation. The only stimulation recommended is with acid to clean up any formation damage that may have occurred during drilling operations. The injection rate capacity calculated for Section 2.5.3 used an undamaged well bore (no skin factor) in the flow model. The Knox had extensive injection and flow testing in the Dupont wells (location 5 on the cross section) with no skin damage or need for stimulation.

The Texas Gas 1A Kerrick well (location 3 on the cross section) is the closest well to the site that demonstrates the higher porosity zone. The Knox porosity zone in the Texas Gas 1A Kerrick well (17.7 km, 11 miles away) is 24 m (79 feet) thick, but net porosity feet above 4% is 16.5 m (54 feet). Mean density porosity is 9.3% (range 4 -17%). Using these parameters, injectivity modeling indicates sufficient injectivity without stimulation.



2.4.4. Primary Seal.

Numerous authors have concluded that the Cambro-Ordovician Maquoketa Shale is the ultimate confining unit for underlying Cambrian-Ordovician aquifers (see references in Young, 1992; McGarry, 1996; Eaton, 2001), including the DOE Phase I findings of two Regional Carbon Sequestration Partnerships (Midwest Regional Carbon Sequestration Partnership (MGSC) and Midwest Geological Carbon Sequestration Consortium (MRCSP), in review). The Maquoketa Shale is estimated to be 131 m (430 feet) thick at the Henderson County site and occurs 373 m. (1,225 feet) above the injection zone. In a regional model of the Maquoketa confining unit, Mandle and Kontis (1992) inferred a vertical hydraulic conductivity of 6.0×10^{-11} ft/s. This unit is regionally widespread and homogenous (Kolata and Noger, 1990; Noger and Drahovzal, 2005). The shale is thought to be a source rock for some Trenton-Black River hydrocarbon production and so may also have carbon adsorptive properties similar to the New Albany Shale (discussed in section 4), which would improve its potential for sealing CO₂. Upper Cambro-Ordovician shales equivalent to the Maquoketa in the Appalachian Basin form the seal for prolific overpressured natural gas fields in West Virginia and New York, further illustrating the sealing capacity of this interval.



There are multiple additional seals above the Cambro-Ordovician Knox Supergroup at the study site. In known Knox reservoirs (injection wells, storage fields, and producing hydrocarbon fields), the surrounding dense carbonates of the Knox (permeabilities of <0.1 md in the Dupont well, well 5 on figure) provide adequate seals. At the study site, there should be 137 m (450 feet) of dense dolomite above the reservoir. Vertical hydraulic conductivities in the Knox-equivalent dolomites in the northern Midwest range from 8.6×10^{-7} to 1.1×10^{-3} ft/day (Young, 1992). In a regional model of this confining unit, Mandle and Kontis (1992) inferred a vertical hydraulic conductivity of 1.0×10^{-11} ft/sec.

Stratigraphically higher seals also occur in the Middle Ordovician Black River carbonates (160 m, 525 feet above the reservoir and 226 m, 740 feet thick), and in the Devonian New Albany Shale (79 m, 260 feet thick and 876 m, 2,875 ft above the reservoir).

See list of references in 2.4.4 Appendix.

2.5. Storage Capacity.

2.5.1. Storage Capacity During Test Phase.

The Alliance suggested that well data within 10 miles (16 km) of the proposed injection wells be used in compiling capacity estimates. The closest data to the site is 11 miles (17.7 km). However, the Cambro-Ordovician Knox Supergroup is a regionally continuous unit known to extend below the site. It serves as an injection zone and producing reservoir in central Kentucky and southern Indiana. The following capacities and plume size were calculated with the Excel spreadsheet provided with the RFP.

2.5.1 Cambro-Ordovician Knox Supergroup 8% of 50MMT=4 MMT		
Input Parameters	Value	Unit
Formation Depth	2249	meters
Formation Thickness	16.5	meters
Effective Porosity	9.3%	
Temperature	54	C
Dissolved NaCl	5.7	molal
Percentage of Injection	8%	
Calculated Parameters		
Formation Pressure	2.20E+07	Pa
CO ₂ Density	7.83E+02	kg/m3
CO ₂ Fugacity Coefficient	4.09E-01	
CO ₂ Henry's Constant	1.11E+09	Pa
CO ₂ Aqueous Mass Fraction	1.98E-02	kg/m3
Aqueous Density	1.2E+03	kg/m3
Water Content	6.5%	
Fixed Parameter		
Mass of Injected CO ₂	4.00E+06	tonnes
Results		
Formation Supercritical CO ₂ Capacity	2.18E+01	kg/m3
Formation Dissolved CO ₂ Capacity	1.54E+00	kg/m3
CO ₂ Plume Areal Extent	10.4	km2
CO ₂ Plume Volume	0.2	km3
Areal Extent:	4.004609	sq mi
	2562.95	acres

2.5.2. Storage Capacity Post-Test Phase.

Cambro-Ordovician Knox Supergroup CO₂ Plume and Capacity Calculations

2.5.2 Cambro-Ordovician Knox Supergroup 100% of 50MMT=50 MMT		
Input Parameters	Value	Unit
Formation Depth	2249	meters
Formation Thickness	16.5	meters
Effective Porosity	9.3%	
Temperature	54	C
Dissolved NaCl	5.7	molal
Percentage of Injection	100%	
Calculated Parameters		
Formation Pressure	2.20E+07	Pa
CO ₂ Density	7.83E+02	kg/m3
CO ₂ Fugacity Coefficient	4.09E-01	
CO ₂ Henry's Constant	1.11E+09	Pa
CO ₂ Aqueous Mass Fraction	1.98E-02	kg/m3
Aqueous Density	1.2E+03	kg/m3
Water Content	6.5%	
Fixed Parameter		
Mass of Injected CO ₂	5.00E+07	tonnes
Results		
Formation Supercritical CO ₂ Capacity	2.18E+01	kg/m3
Formation Dissolved CO ₂ Capacity	1.54E+00	kg/m3
CO ₂ Plume Areal Extent	129.6	km2
CO ₂ Plume Volume	2.1	km3
Areal Extent:	50.05762	sq mi
	32036.87	acres

2.5.3. Injection Rate Capacity.

Injection rate capacity for the Knox injection zone was calculated using software written by Computer Modeling Group, Ltd. The particular simulator used in this study was the IMEX simulator (Implicit-Explicit Black Oil Simulator). As the name implies, the simulator has been designed to model the performance of reservoirs that contain oil-gas-water. For this model, the IMEX simulator was modified and adapted to handle a reservoir that is 100% saturated with water and where carbon dioxide is injected into the reservoir. Petrophysical data obtained from wells that penetrated the Knox in other areas were used to construct the model. Also, since no data were available concerning variations in the Knox with distance, it was assumed that formation thickness, porosity and permeability were uniform with distance.

The model that was developed had dimensions of 21 X 21 X 1. Variations in the area considered were accomplished by varying the dimensions of the blocks. The inputs for the project were as follows:

- Formation depth (top): 7380 feet
- Formation thickness: 54 feet
- Formation porosity: 9.3 percent
- Formation permeability: 60.0 millidarcies
- Saturation: 100% water
- Formation pressure: 0.433 psi/ft X depth to midpoint of reservoir (7,407 ft)
- Max. injection pressure: 0.65 psi/ft X depth to midpoint of reservoir (7,407 ft)

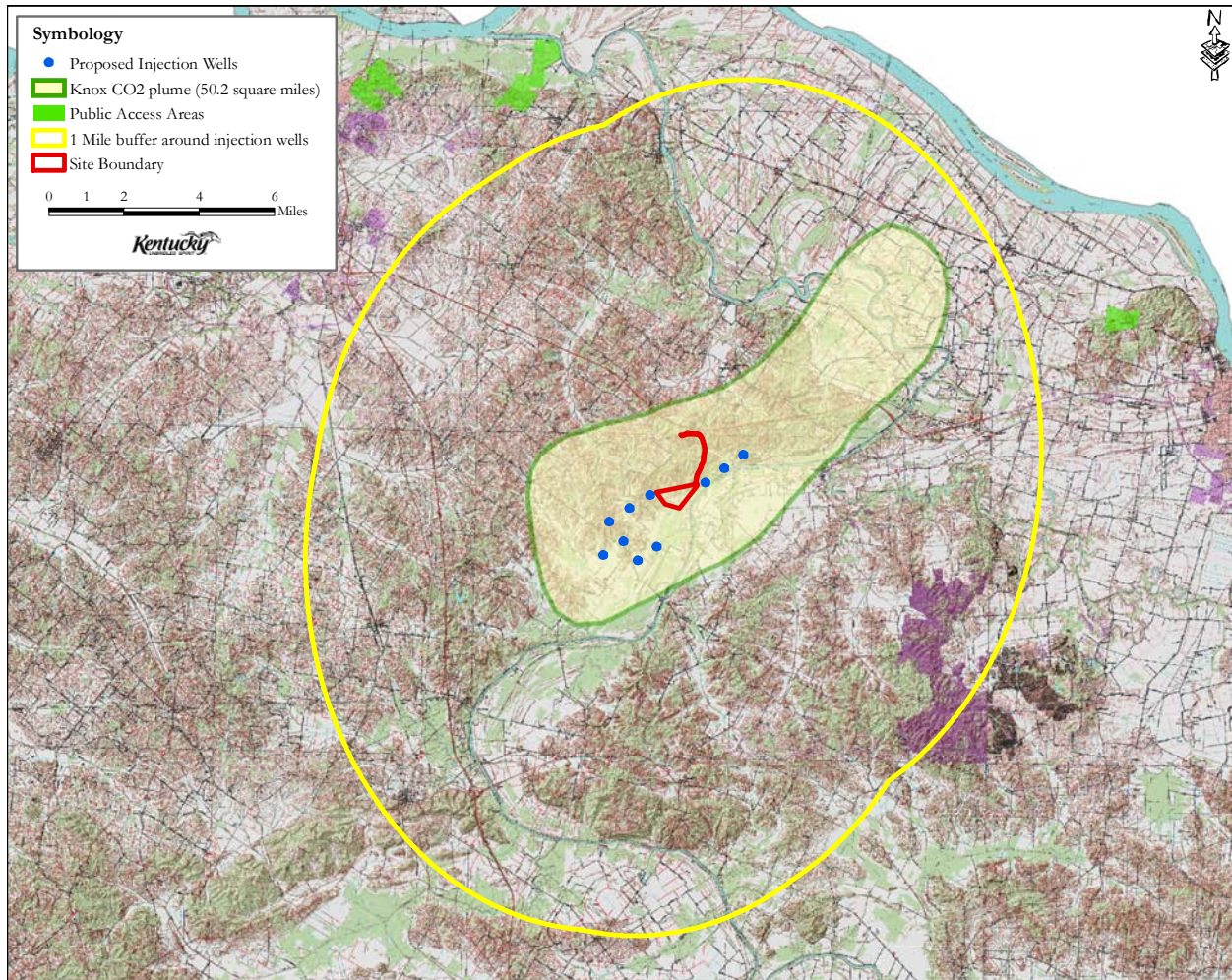
The study indicated that to inject the approximately 52,000,000 SCF/day (equivalent to the 1 MMT of CO₂ per year requirement) of carbon dioxide into the Knox would require 200 acres spacing and 10 vertical wells. It is important to understand that the dominant variables in the study were the capacity of the reservoir (porosity times gross reservoir volume) and the differential pressure permitted between the bottom hole and the reservoir.

The controlling boundary conditions for this study were initial reservoir pressure and a maximum injection pressure. The initial reservoir pressure used in the study was predicated on a "normal" gradient of 0.43 psi/ft. This gradient approximates a column of freshwater that exists from the surface to total depth. The maximum injection pressure of 0.65 -psi/ft. was based on the fracture gradient obtained from a well penetrating the Knox at a shallower depth than in the site area. The model used a point source for injection. In all cases the limiting factors that impacted the capability to inject carbon dioxide into the formation were the lack of capacity (porosity) and the inability to exceed an injection pressure greater than 4,815 psi (the gradient of 0.65 -psi/ft times depth).

2.6. Safety and Security.

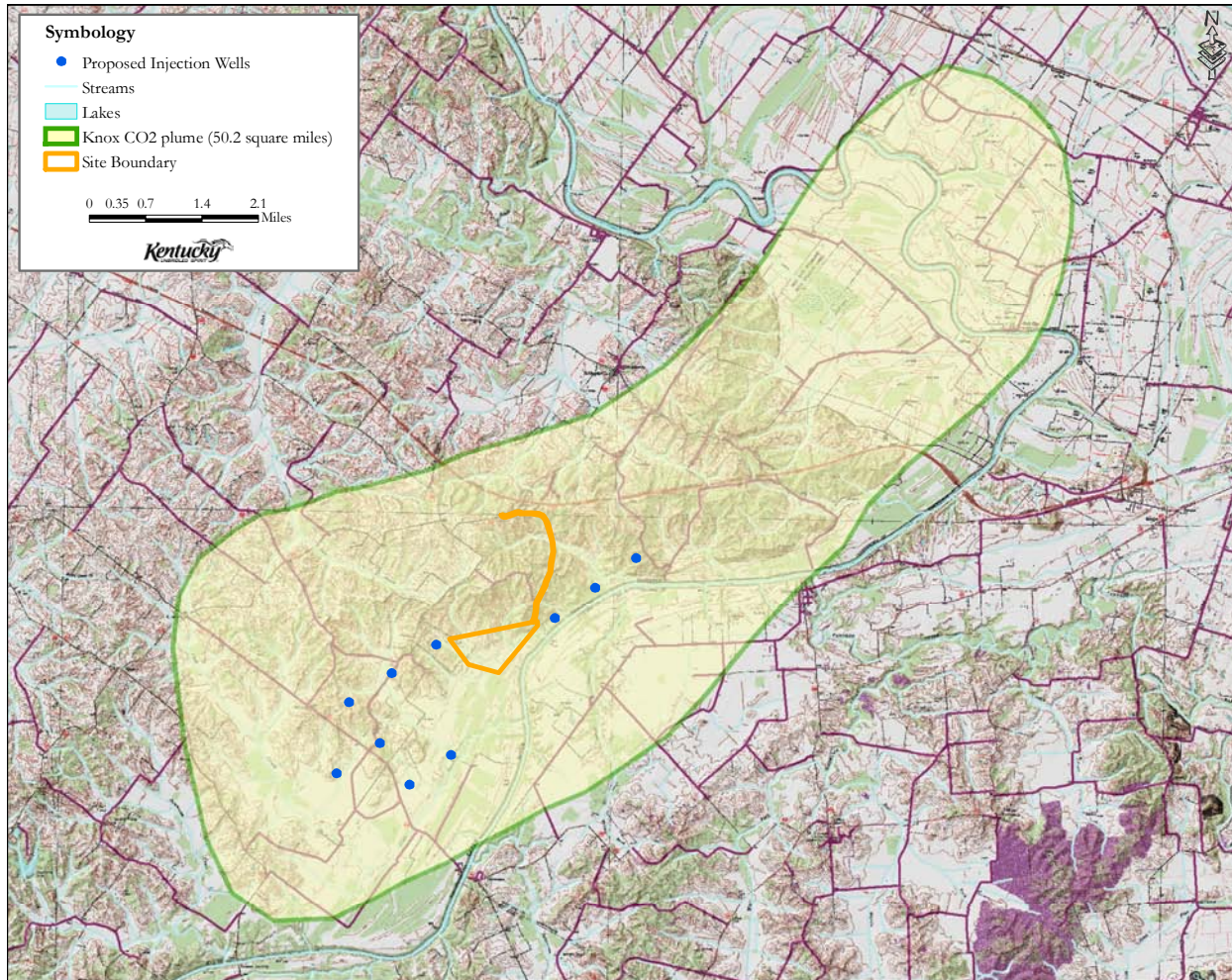
2.6.1. Public Access Areas.

Multiple injection wells are proposed near the site. There are no public access areas (PAA) within ten miles of any injection well.



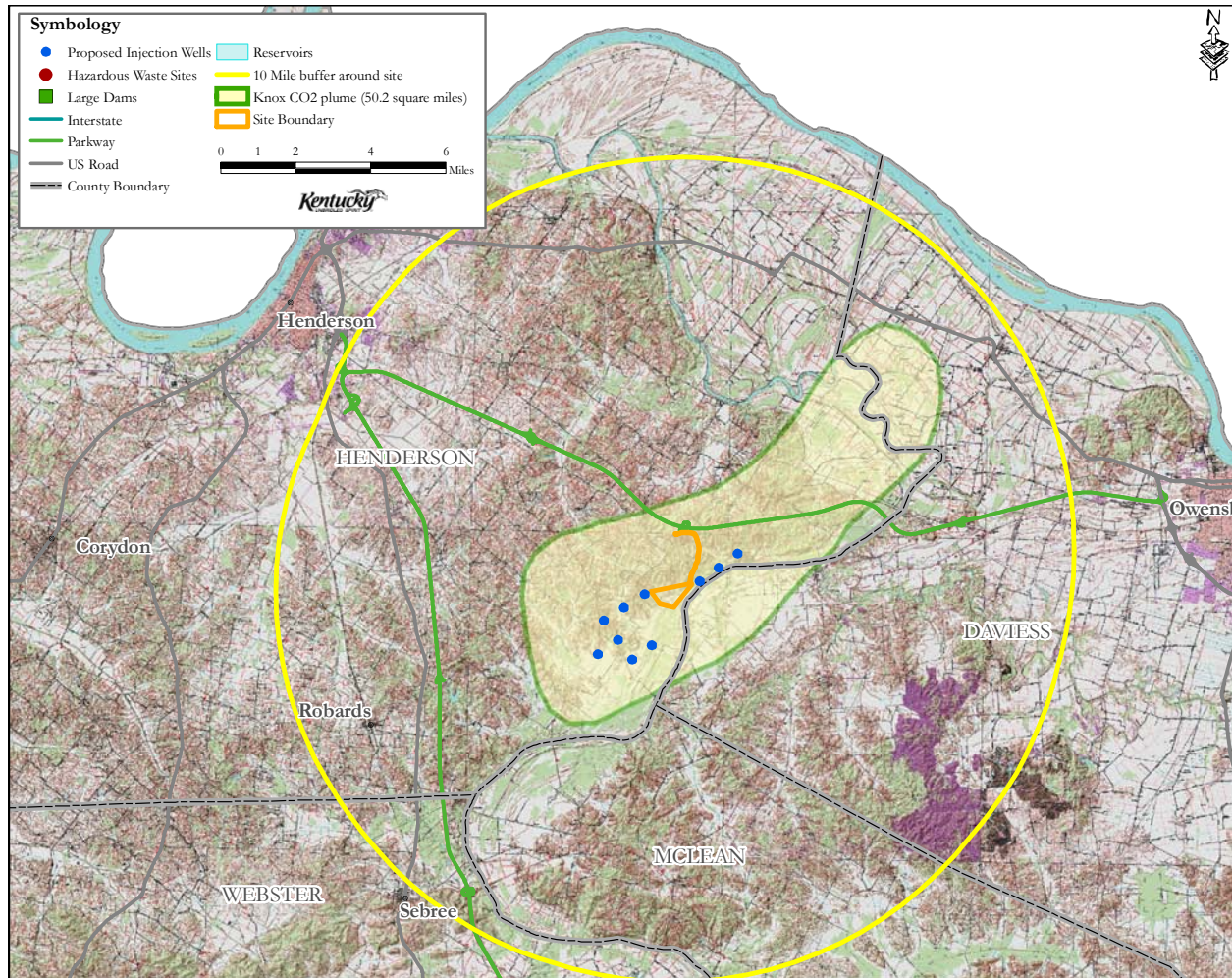
2.6.2. Marine Shorelines and Lakes.

The map illustrates the maximum extent of the calculated plume in the primary target formation. The plume does not underlie any marine shoreline or lake.



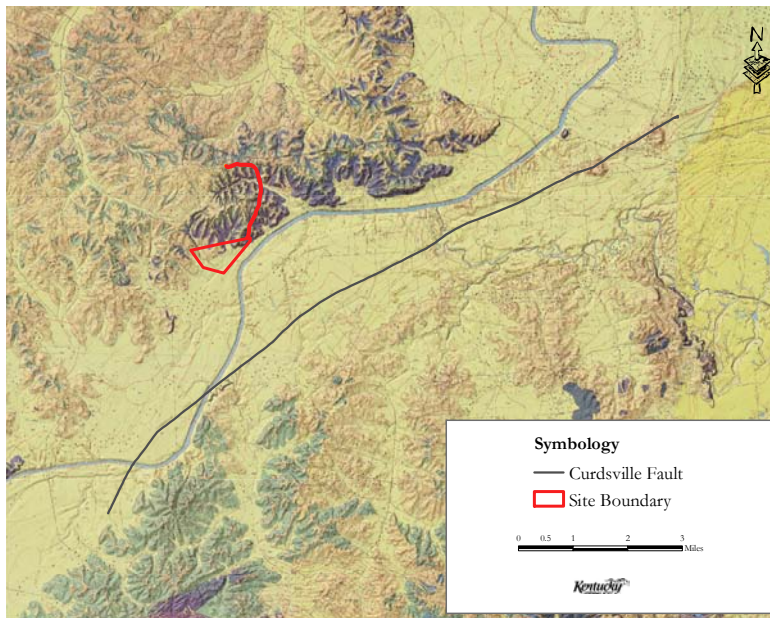
2.6.3. Sensitive Features.

There are no sensitive features within 10 miles of the bottomhole location of any injection well. Verification has been received from US EPA Region IV Atlanta office that there are no Class I wells intersecting the target formation. The EPA notification can be found in 2.6.3 Appendix.



2.6.4. Relation of Primary Seal to Active or Transmissive Faults.

There are no active or known transmissive faults that intersect the primary seal. Kentucky is one of the few states that has been completely geologically mapped at 1:24,000 scale, and as a result, Kentucky has more accurate fault coverage than most states. One fault, the Curdsville fault, just southeast of the proposed site was inferred beneath alluvium on the Delaware quadrangle (Johnson, 1973). The fault is also confirmed on the reflection seismic data interpreted for this project, including one line crossing the site. The fault is oriented NE-SW and is downthrown to the SE. Maximum offset at the top of the Knox is estimated to be 30 m (100 feet) east of the site and 46.1 m (150 feet) to the northeast. Due to the fact that the Curdsville fault dips to the southeast,



its subsurface location is displaced in that direction at the Knox horizon. The maximum fault displacement of 150 feet is less than the thickness of the Maquoketa Shale (430 feet), indicating there is continuity of the primary seal across the fault.

There is no quantitative data indicating whether the Curdsville fault is transmissive or sealing. There are oil fields on both sides of the fault that are apparently sealed with no reported hydrocarbon leaks or seeps along the fault at the surface, implying that the fault is a

sealing fault. More importantly, within ductile shale intervals like the Maquoketa, the fault zone is characterized by clay fault gouge, creating a barrier to fluid flow. This fault is not seismically active.

Reflection seismic data also show a series of small, fault-bounded grabens oriented sub-parallel to the Curdsville fault, 8.3 km (4.9 miles) south of the site. These faults were not mapped at the surface (Johnson, 1973). They were interpreted only on seismic line 1 and do not occur on line 2 that is nearer to the site. Offset is estimated to be less than 15 m (50 feet) on individual faults. These faults are not seismically active and there is no evidence that they are transmissive.

The seal capacity of faults in the area is also indicated by a successful secondary oil recovery project using mixed nitrogen/CO₂ gas injection into a shallow Pennsylvanian sandstone reservoir in adjacent Union County (Duchscherer, 1965). The Spring Grove pool in this example is a structural closure trapped by the Rough Creek fault zone, which is similar in age and tectonic style to the Curdsville fault. Gas injection of 240,000 SCFD resulted in a 5-fold increase in oil production with no reports of fault seal problems.

See list of references (2.6.4 Appendix).

2.7. Permitting.

2.7.1. Deep Well UIC Permits.

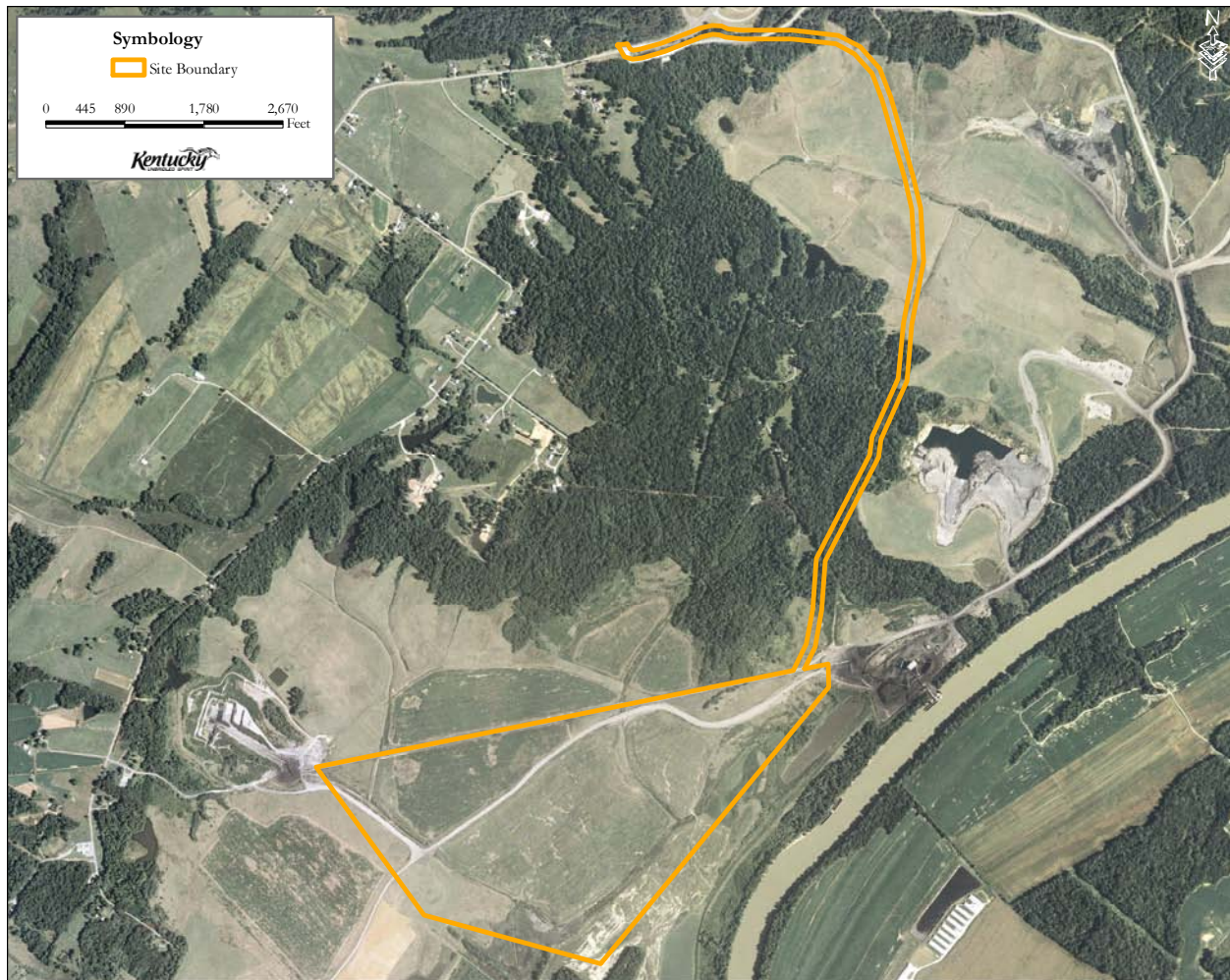
The authority for permitting UIC wells in Kentucky is retained by the United States Environmental Protection Agency (U.S. EPA) and is administered in the Region IV office in Atlanta. U.S. EPA Region IV will review Kentucky sites under the direction implementation program for the issuance of UIC permits appropriate for the injection of CO₂.

PART 3--Power Plant Scoring Criteria

3.1. Physical Characteristics.

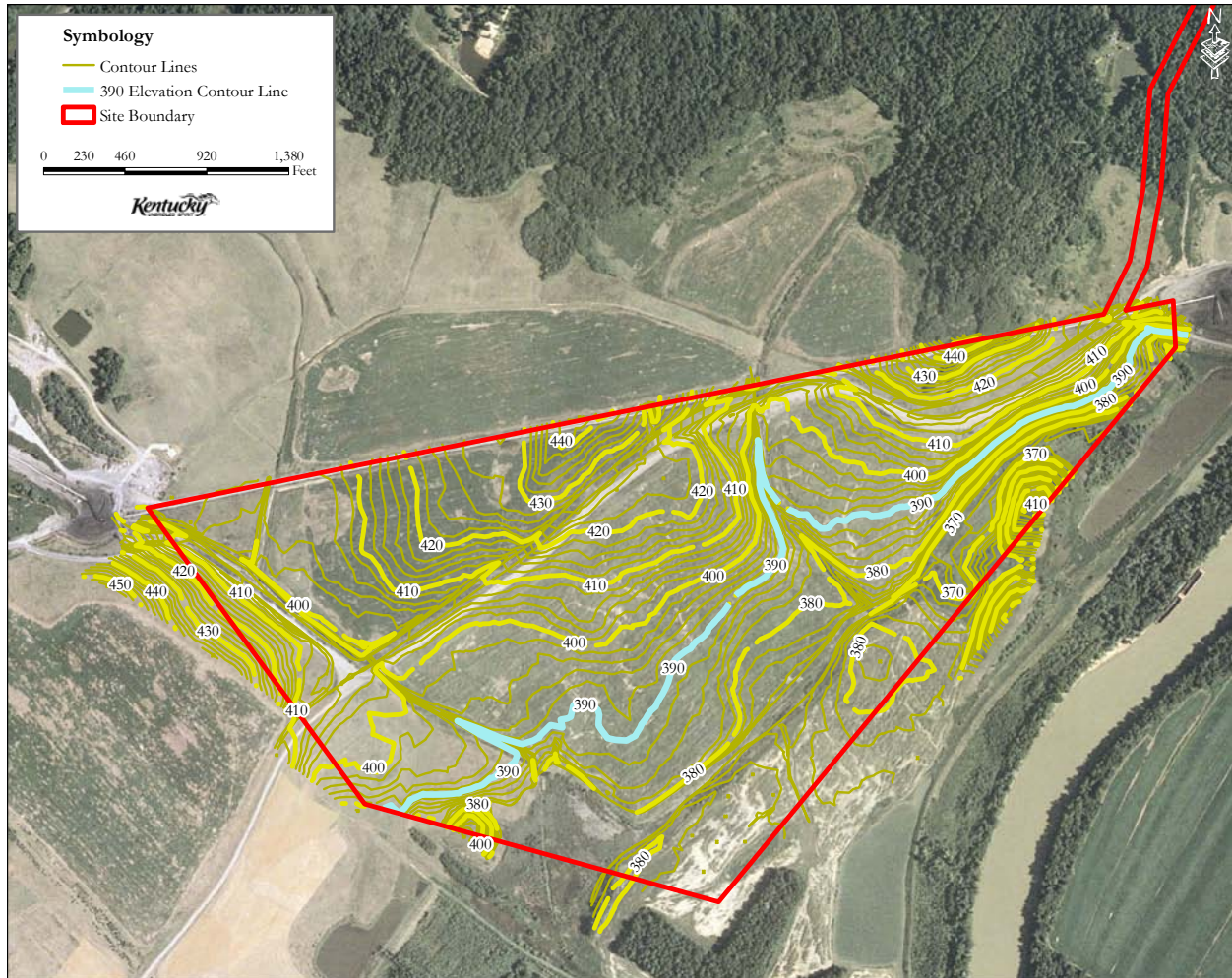
3.1.1. Size.

The site footprint comprises approximately 215 acres with a 23 acre proposed access road. The Commonwealth has existing relationships with owners of the lands immediately adjacent to the FutureGen site, approximately 16,000 acres. Additional reclaimed surface mine lands are present in the area adjacent to the site. If additional acreage is desired, the Commonwealth agrees to assist the FutureGen Alliance in identifying and negotiating with owners of these sites.



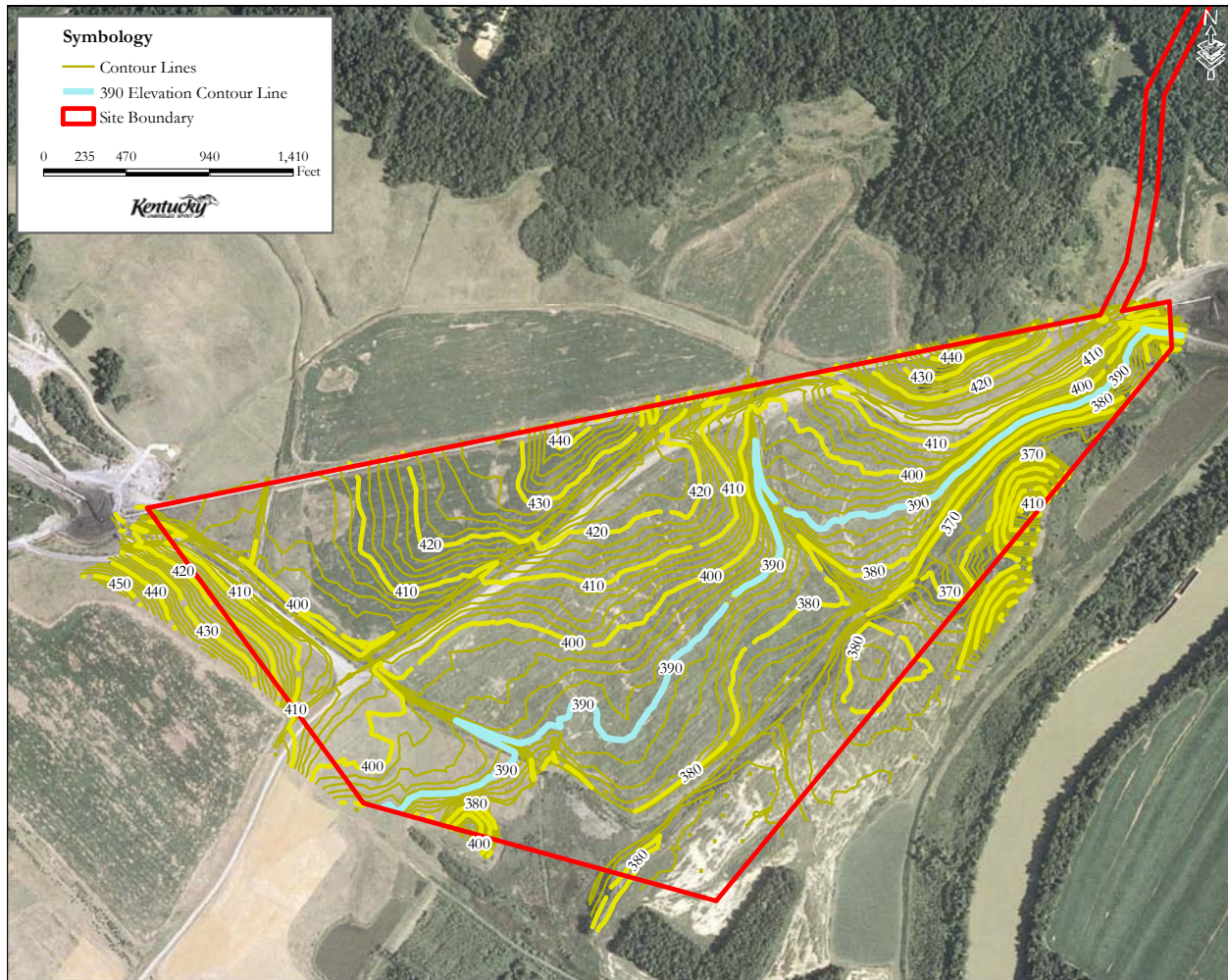
3.1.2. Topography.

The percent of slope is 4% across the proposed FutureGen site. These determinations are based on the site survey completed in April 2006.



3.1.3. Elevation.

The highest elevation is 449 feet above mean sea level (MSL). The lowest elevation at the proposed FutureGen site is 370 feet MSL. These determinations are based on the site survey completed in April 2006.



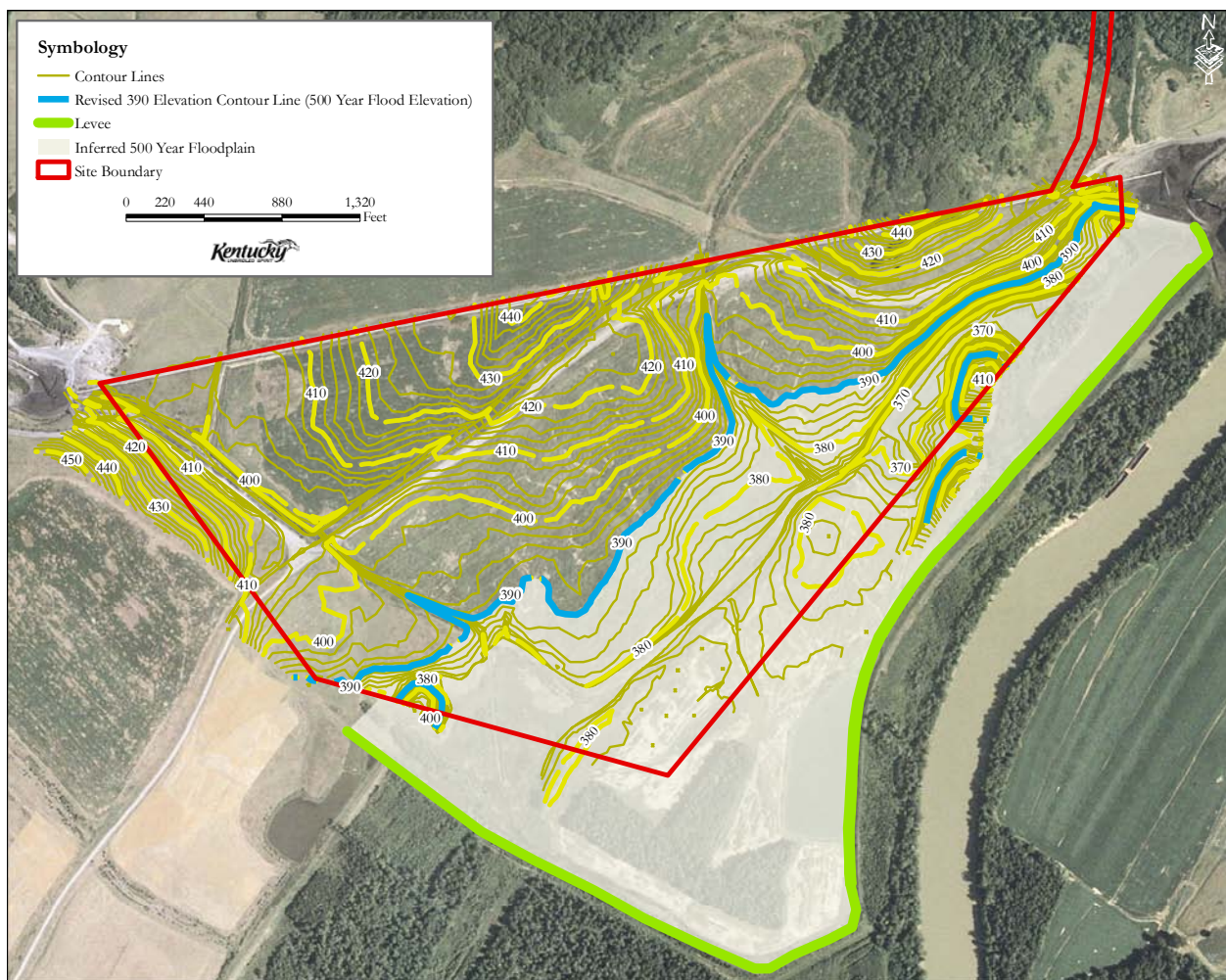
3.1.4. Floodplains.

One hundred and forty-six acres of the proposed site lie out of the 100-year floodplain.

The FEMA floodplain map indicates that the proposed FutureGen site lies within the combined Ohio River and Green River floodplains. The 100-year flood elevation at the site is 386 feet above mean sea level (amsl) and the 500-year flood elevation is 390 feet (amsl). Because the site has been modified by surface mining since the creation of the topographic quadrangle map and the FEMA floodplain map, a recent site topographic survey is used to identify the floodplain boundary.

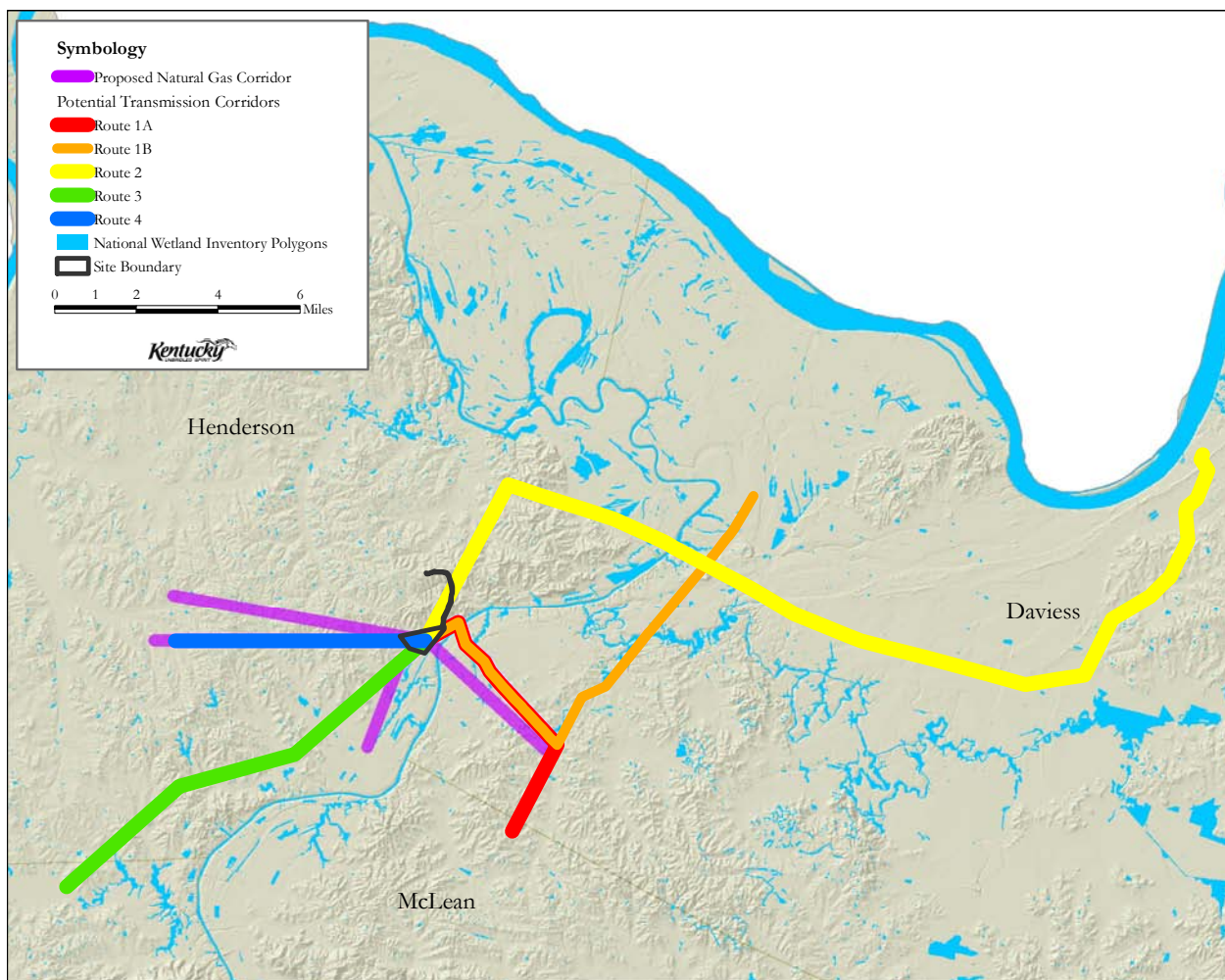
The 500-year floodplain elevation is indicated by highlighting the 390 feet contour on the recent site survey and the 100-year floodplain boundary is marked closely parallel to this at the 386 foot level.

The floodplain information was obtained from FEMA flood maps of the Henderson County, with published date of Feb. 6, 1991. The site encompasses two panels, #210286 0150B and #210286 0200B.



3.1.5. Wetlands.

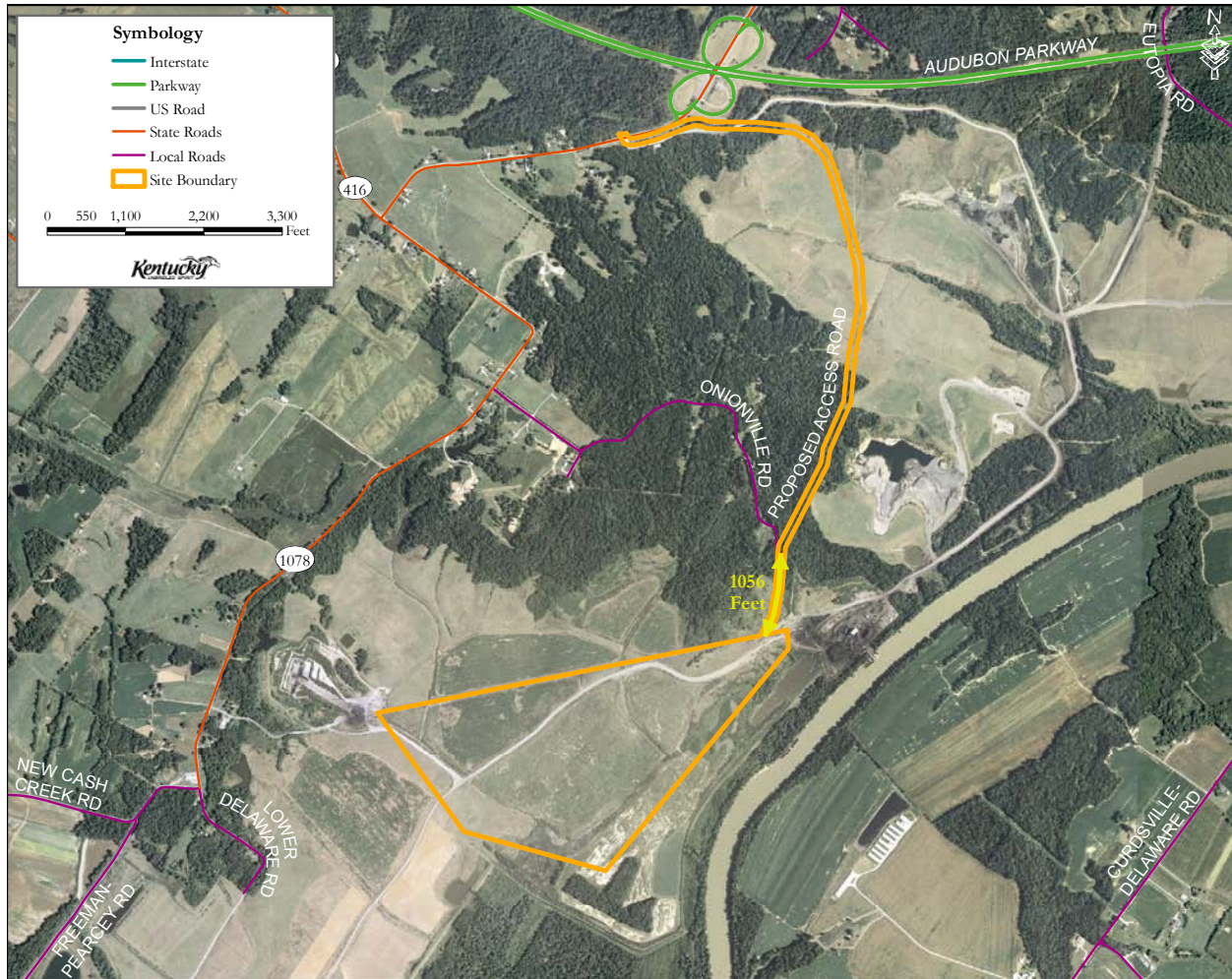
The proposed Kentucky FutureGen site will have no adverse impacts on wetlands on site. Approximately ten acres of wetlands are present on the proposed power plant site. This wetland is a marsh drained by an intermittent stream in an area heavily impacted by mining and agriculture. The man-induced effects reduce the quality of this site which is on reclaimed land and is approximately five to ten years old. Aging is required to further develop the hydric soils while some wetland flora (willows and rushes) are established. The electric and gas transmission corridors will have no impact on wetlands. The surrounding terrain is such that wetlands can be avoided in the construction of electric and gas transmission lines. See the preliminary environmental review letter in 3.1.5 Appendix.



3.2. Other Site Characteristics.

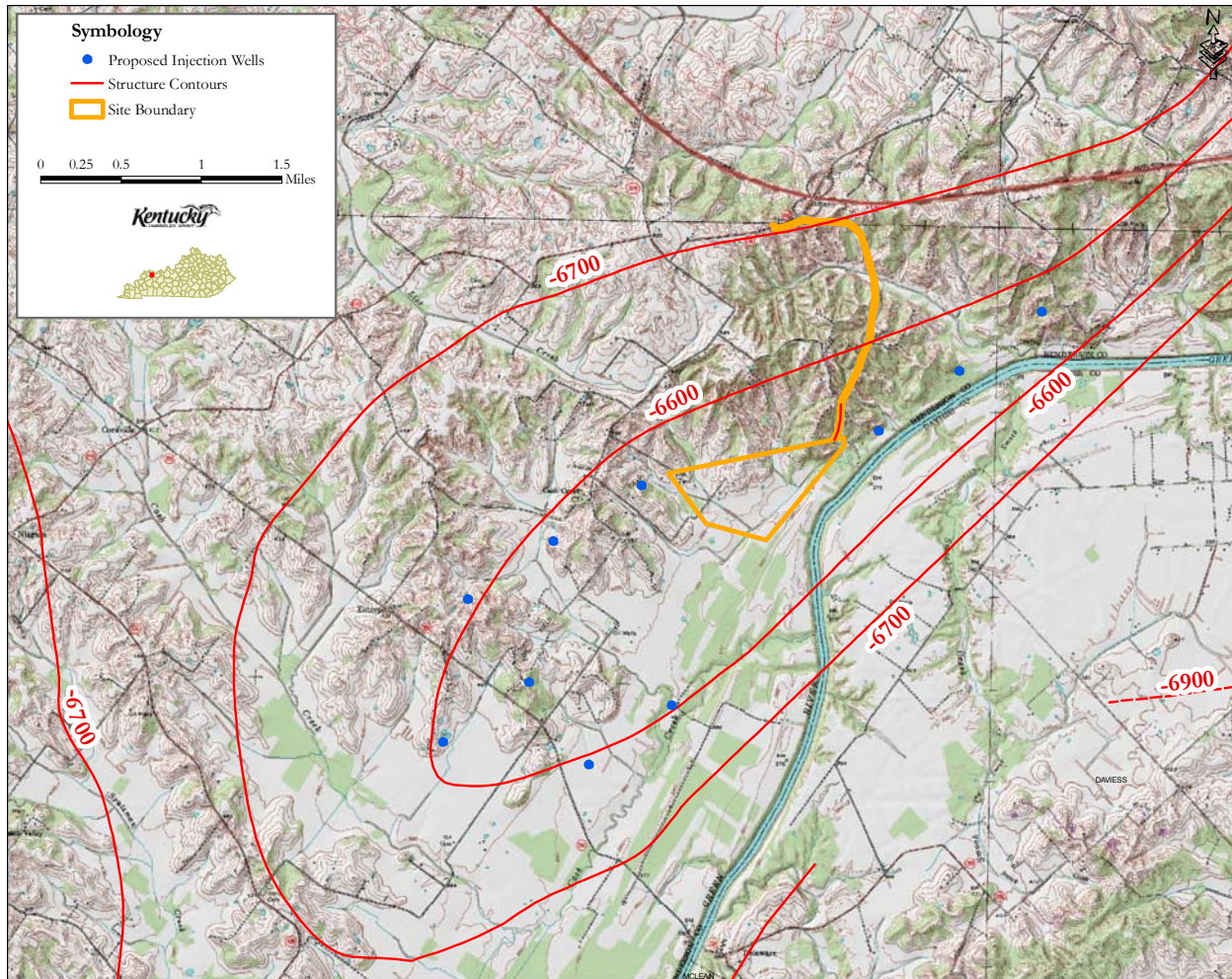
3.2.1. Road Access.

The distance from the proposed FutureGen site to the county road intersection is 1.3 miles or 7,200 feet. The distance from the proposed site to the Audubon Parkway is 1.5 miles or 7,800 feet.



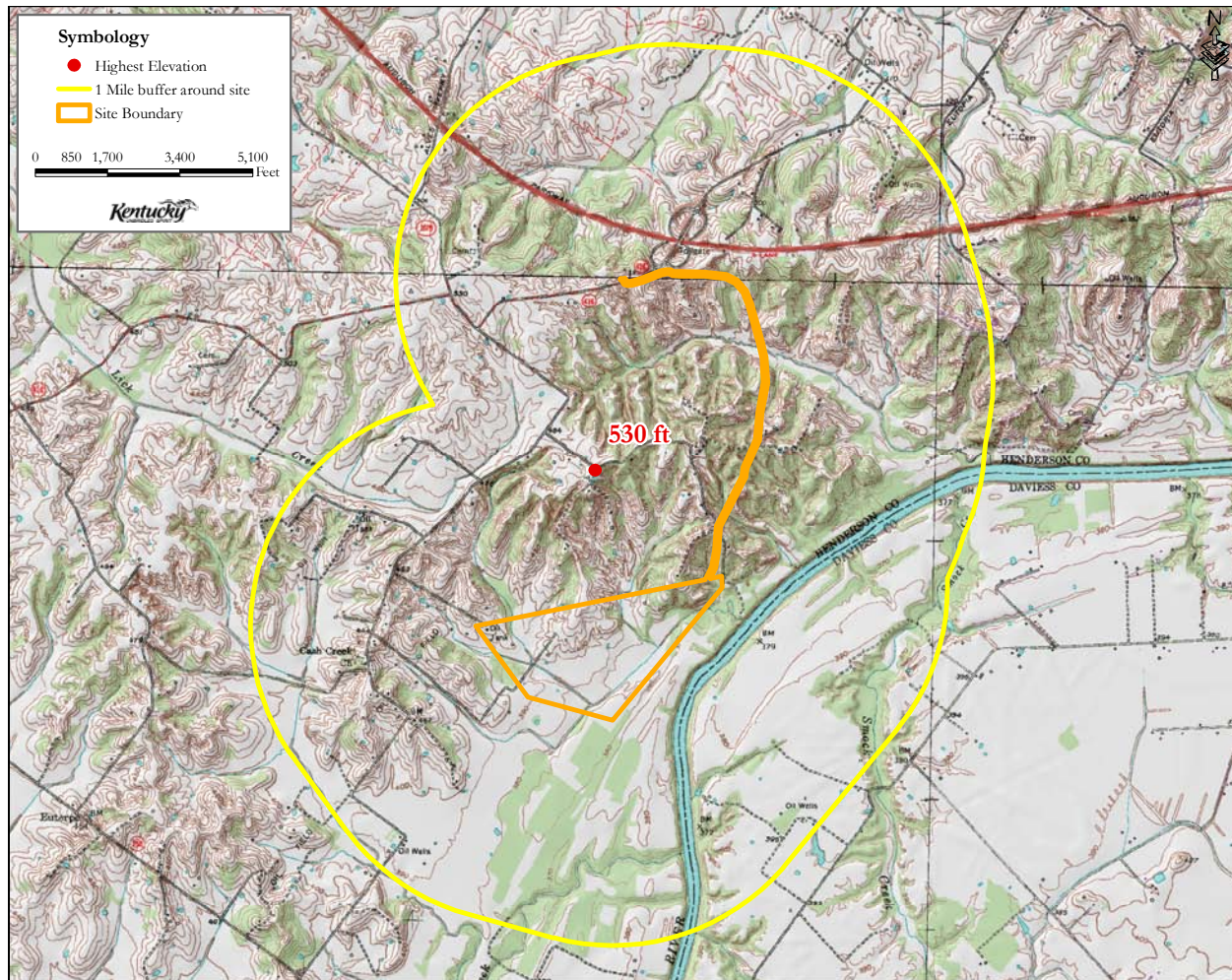
3.2.2 Proximity to Proposed Target Formation.

The Kentucky FutureGen site directly overlies the Knox Supergroup and the structure identified on seismic that is hypothesized as the main storage target. All injection wells are within approximately 8,000 feet of the site. No access corridors are necessary because agreements are in place to negotiate easement within the Cash Creek and Penn Virginia properties, which are adjacent.



3.2.3 Air Dispersion.

The lowest elevation in the vicinity of the proposed FutureGen facility is estimated to be 113 m (370 ft). The highest elevation within 1.6 km (1 mile) of the proposed site is 162 m (530 ft) above mean sea level. These determinations are based on the Delaware 7.5-minute topographic quadrangle (1953) and a new survey of the reclaimed surface mine area within the FutureGen site.

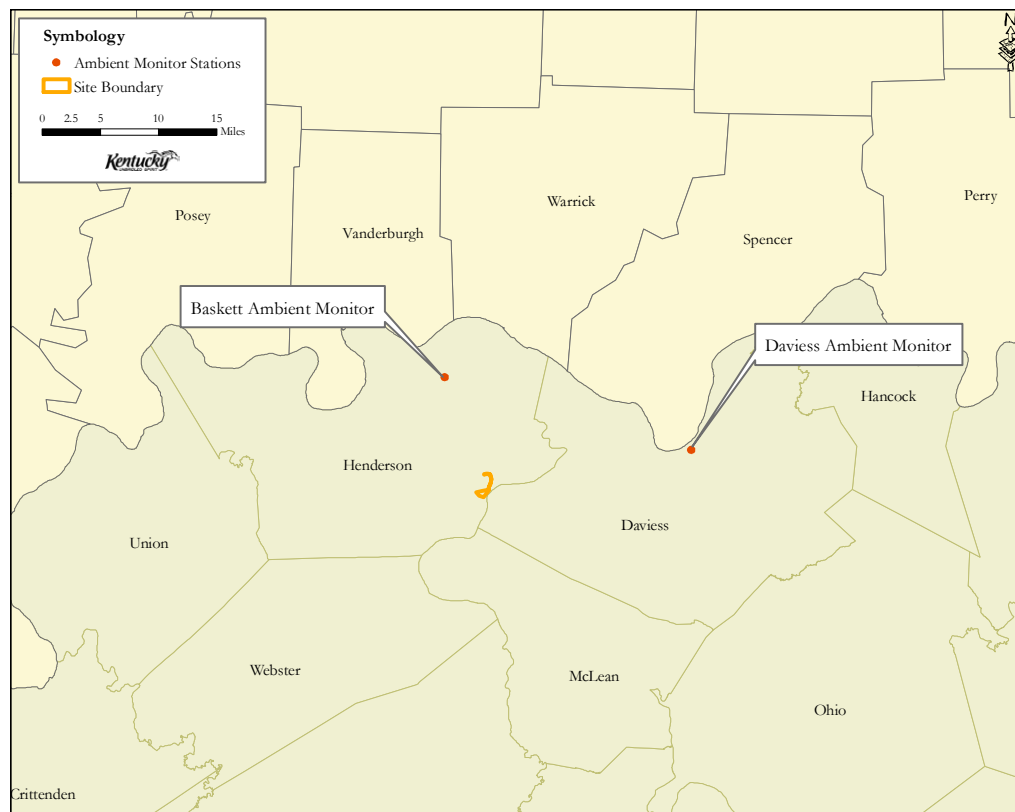


3.2.4 Air Quality.

The Kentucky Division for Air Quality operates an air monitoring station in the vicinity of Baskett in Henderson County. The site is approximately 17.5 km NNW of the proposed Cash Creek site. The site collects SO₂, NO_x, Ozone, PM_{2.5} and PM₁₀ data. Based on data collected at the site, Henderson County and contiguous counties in Kentucky (Union, Webster, McClean, and Daviess) are currently attainment for all criteria pollutants.

Daviess County, Kentucky, is listed as a maintenance area for the old one-hour ozone standard. While this standard is no longer in existence, Kentucky is required to show continued maintenance under the eight-hour standard for a period of at least 12 more years. Daviess County successfully demonstrated continued maintenance with the one-hour standard from 1995 until it was replaced by the eight-hour standard. Since US EPA designated areas as attainment/non-attainment in 2004, Daviess County has not been in violation of the eight-hour standard.

Vanderburg and Warrick Counties in Indiana were originally designated as non-attainment for the eight-hour ozone standard, but were recently redesignated as meeting that standard (effective January 30, 2006). Vanderburg, Warrick, and Dubois Counties, and parts of Gibson, Pike, and Spencer Counties (all in Indiana), were designated by US EPA as non-attainment for the fine particulate standard. Any new source cannot cause or contribute to exceedences of any standard in downwind areas. However, due to the small amounts of fine particulate matter emissions predicted from the FutureGen project, it is not anticipated that the proposed Kentucky site will cause fine particulate exceedences in any of these counties.



3.2.5 Existing Land Use.

The FutureGen facility will be located on the 250 acre site as shown on the exhibit and within a one mile radius the surrounding land uses are compatible with that of a power plant. The 250 acre site is part of a comprehensive 1,923 acre site that was rezoned to M-2 Heavy Industrial, which permits power plants in this zone. The map indicates that the current land uses for the site are agricultural and surface mining and within the one mile radius of the site, similar and compatible land uses exists, as well as the M-2 zoning classification which supports the compatible uses.

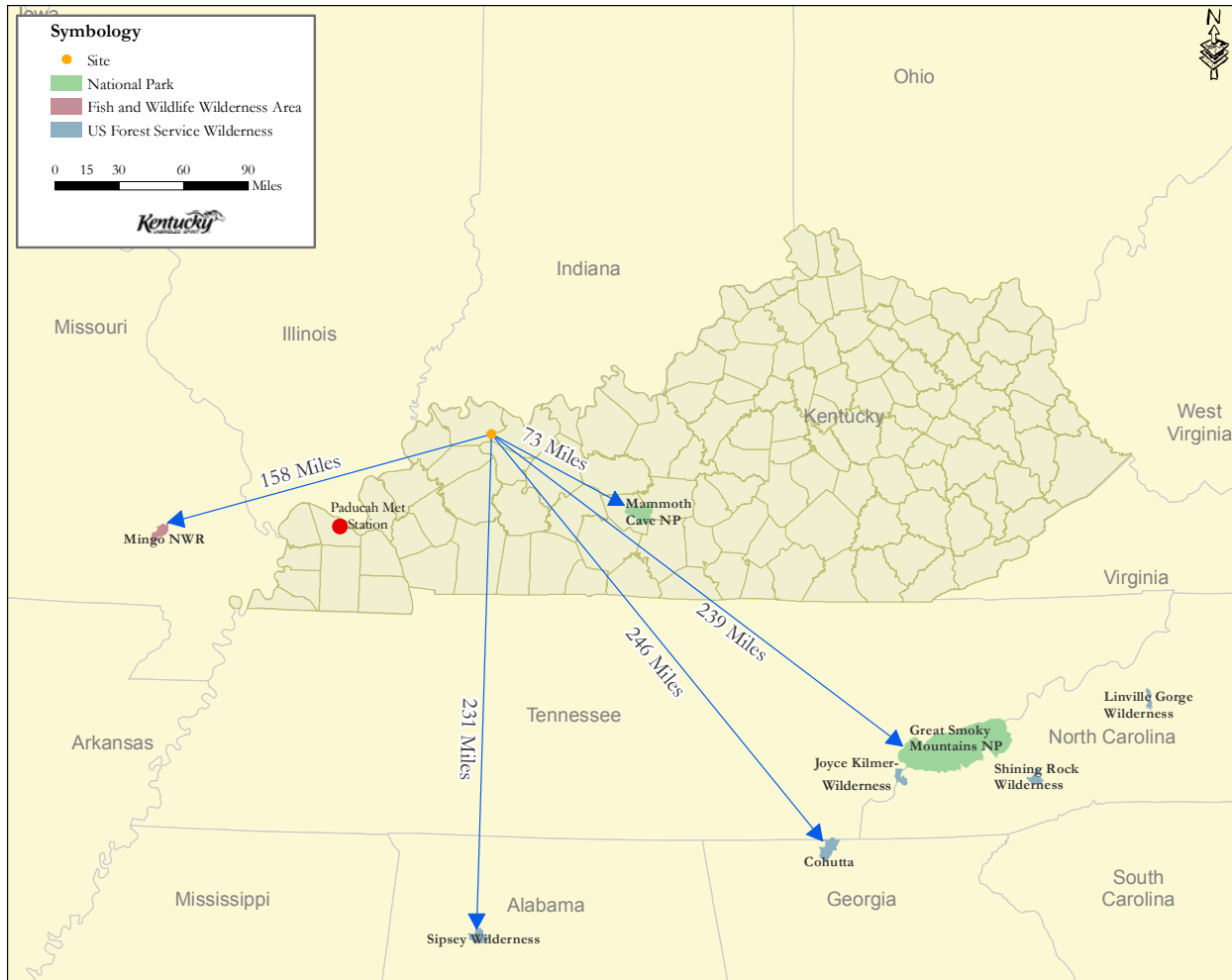
Local Zoning Map for Henderson County, Kentucky



3.3. Proximity to Sensitive Areas.

3.3.1. Class I Visibility Areas.

The closest Class I area to the proposed Kentucky site is Mammoth Cave National Park. It is located approximately 115 km (73 miles) from the site.



3.3.2. TES and Critical Habitat.



United States Department of the Interior

FISH AND WILDLIFE SERVICE
3761 Georgetown Road
Frankfort, Kentucky 40601

April 18, 2006

Ms. Talina Matthews
Kentucky Office of Energy Policy
12th Floor, Capital Plaza Tower
500 Mero Street
Frankfort, Kentucky 40601

Subject: FWS 06-0784; Species Information Request for Property in Henderson County, Kentucky

Dear Ms. Matthews:

We received your email requesting information on the presence of threatened and endangered species and/or federally designated critical habitat at a specific property in Henderson County, Kentucky. According to your email, the subject property would be used to construct a zero emission coal fired power plant. Fish and Wildlife Service (Service) personnel have reviewed the information submitted, and we offer the following comments.

Endangered species collection records available to the Service do not indicate that federally listed or proposed endangered or threatened species occur within the specific property you have identified in Henderson County. Also, no critical habitat has been designated to include the specific property. We note, however, that the collection records available to us may not be all-inclusive. Our database is a compilation of collection records made available by various individuals and resource agencies. This information is seldom based on comprehensive surveys of all potential habitat and thus does not necessarily provide conclusive evidence that protected species are present or absent at a specific locality.


Although we do not have specific occurrence records for the specific parcel, our records do indicate that a number of federally listed species are known to occur in Henderson County. These species, listed below, could occur on the project site if suitable habitat is present:

<u>Common Name</u>	<u>Scientific Name</u>	<u>Federal Status</u>
Bald eagle	<i>Haliaeetus leucocephalus</i>	threatened
Indiana bat	<i>Myotis sodalis</i>	endangered
Fanshell	<i>Cyprogenia stegaria</i>	endangered
Ring pink	<i>Obovaria retusa</i>	endangered
Pink mucket	<i>Lampsilis abrupta</i>	endangered
Fat pocketbook	<i>Potamilus capax</i>	endangered
Catspaw	<i>Epioblasma obliquata obliquata</i>	endangered
American burying beetle	<i>Nicrophorus americanus</i>	endangered

If this specific property is chosen for the construction of the power plant, we look forward to providing further comments regarding project construction activities pursuant to section 7 of the Endangered Species Act. Please be aware that this letter does not provide clearance from the Service for the project to proceed. This letter is only meant to provide information regarding known occurrences of threatened and endangered species and critical habitat within the subject property and Henderson County, Kentucky.

Thank you for the opportunity to comment on this proposed action. If you have any questions regarding the information that we have provided, please contact Mindi Lawson at (502) 695-0468 (ext. 229).

Sincerely,


Virgil Lee Andrews, Jr.
Field Supervisor

According to the United States Fish and Wildlife Service, their endangered species collection records do not indicate that federally listed or proposed endangered or threatened species occur within the FutureGen site. Also, no critical habitat has been designated to include the site. The areas surrounding the site which are proposed to be utilized for transmission corridors are similar to the site and are expected to have similar characteristics. Existing transmission corridors are used to the extent possible, therefore minimizing impact on the habitats of species in the area.

3.3.3. Cultural Resources.

There are no documented occurrences of cultural, historical, or archaeological resources or Traditional Cultural Properties on or within one mile of the proposed power plant site boundary or any new transmission line, transportation or pipeline corridor.

The transmission additions will utilize existing rights of way to the extent possible. The proposed access road and proposed pipeline corridor are in areas presently part of an active mine or have been mined and would contain no such resources or properties.



COMMERCE CABINET
KENTUCKY HERITAGE COUNCIL

Ernie Fletcher
Governor

The State Historic Preservation Office
300 Washington Street
Frankfort, Kentucky 40601
Phone (502) 564-7005
Fax (502) 564-5820
www.kentucky.gov

George Ward
Secretary

David L. Morgan
Executive Director and
State Historic Preservation Officer

March 30, 2006

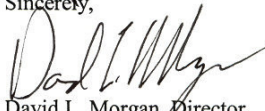
Mr. Andrew V. McNeill
Acting Executive Director
Office of Energy Policy
Capital Plaza Tower, 12th Floor
500 Mero Street
Frankfort, KY 40601

Dear Mr. McNeill:

Thank you for your letter of March 22, 2006 concerning a possible site for the FutureGen project. This project will be a joint effort between the U. S. Department of Energy and the Industrial Alliance to construct and operate a zero-emissions coal-fired electricity generating facility. The principal site being considered is located in southeastern Henderson County, Kentucky adjacent to the Green River. Your letter indicates that the proposed project area was part of a larger coal mining area that has been reclaimed. A review of our files indicates that the project was subjected to archaeological surveys in 1986 and that one significant archaeological site was mitigated in 1988. Further, there are no recorded structures within the area of direct impact. Consequently, the proposed FutureGen project will have no effect on any property currently listed in or eligible for listing in the National Register of Historic Places. In accordance with 36CFR Part 800.4 (d) of the Advisory Council's revised regulations our finding is that there are No Historic Properties Present within the undertaking's area of potential impact. Therefore, we have no further comments and the Agency Official's responsibility to consult with the State Historic Preservation Officer under the Section 106 review process is fulfilled.

Should you have any questions, feel free to contact Charles Hockensmith of my staff at (502) 564-7005.

Sincerely,

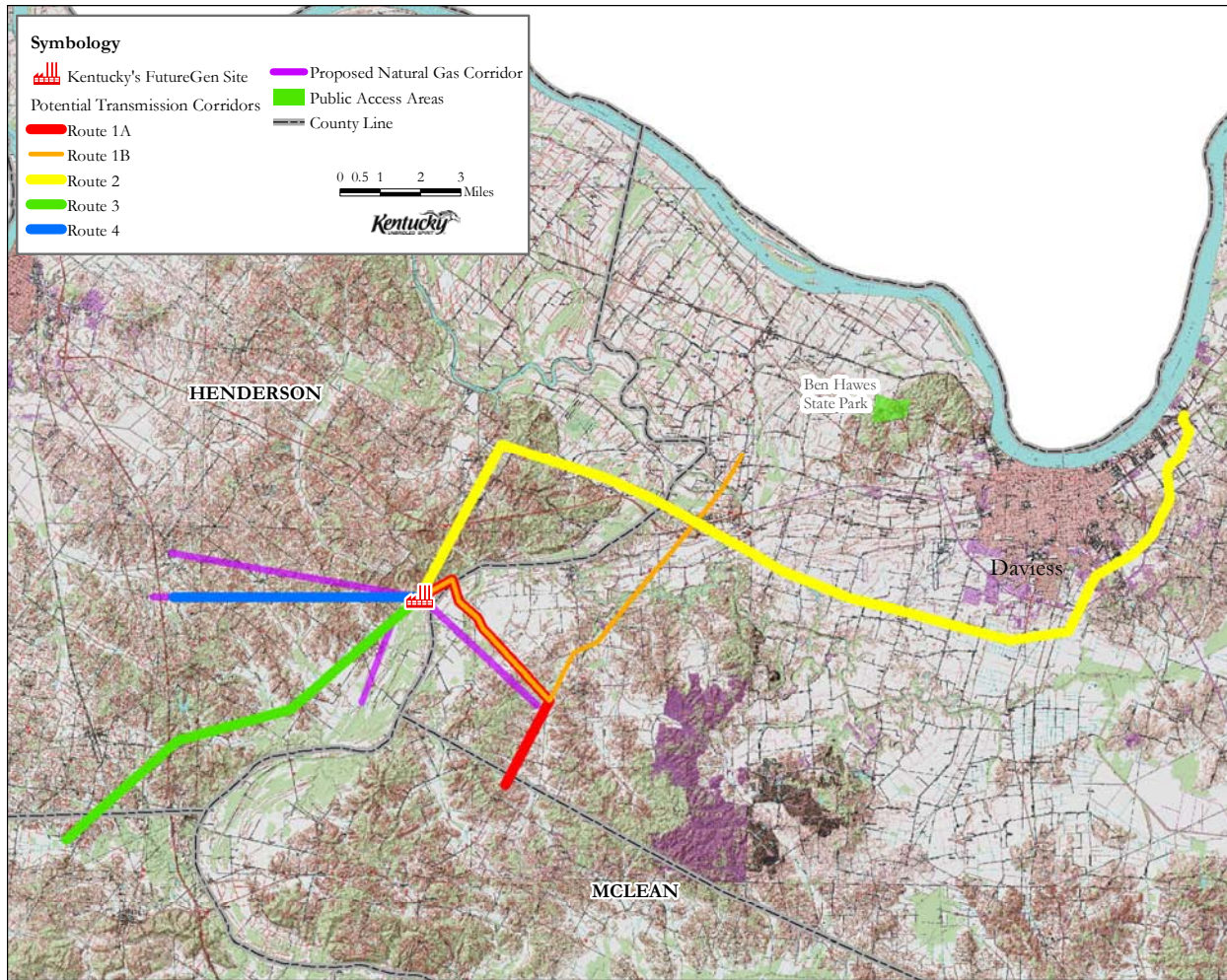


David L. Morgan, Director
Kentucky Heritage Council and
State Historic Preservation Officer



3.3.4. Public Access Areas.

The map below illustrates the PAA areas in the vicinity of the proposed Future-Gen site of which the closest, the Ben Hawes State Park, is approximately 5 miles from one of the proposed transmission lines.



3.3.5. Non-Attainment / Maintenance Areas.

Daviess County, Kentucky, is the closest maintenance area to the proposed site. It is approximately one-quarter mile away. Daviess County is a maintenance area for the eight-hour ozone standard. Daviess County, Kentucky, is also listed as a maintenance area for the old one-hour ozone standard. While this standard is no longer in existence, Kentucky is required to show continued maintenance under the eight-hour standard for a period of at least 12 more years. Daviess County successfully demonstrated continued maintenance with the one-hour standard from 1995 until it was replaced by the eight-hour standard. Since U.S. EPA designated areas as attainment/non-attainment in 2004, Daviess County has not been in violation of the eight-hour standard.

Vanderburg County, Indiana, is the closest non-attainment area; it is non-attainment for fine particulate matter along with Warrick and Dubois Counties, and parts of Gibson, Pike, and Spencer Counties in Indiana. Vanderburg County is located approximately 14 miles from the site. Vanderburg and Warrick Counties in Indiana are also maintenance areas for eight-hour ozone after recent redesignation of meeting the standard (effective January 30, 2006). Any new source cannot cause or contribute to exceedences of any standard in downwind areas. However, due to the small amounts of fine particulate matter emissions predicted from the FutureGen project, it is not anticipated the proposed Kentucky site will cause fine particulate exceedences in any of these counties.

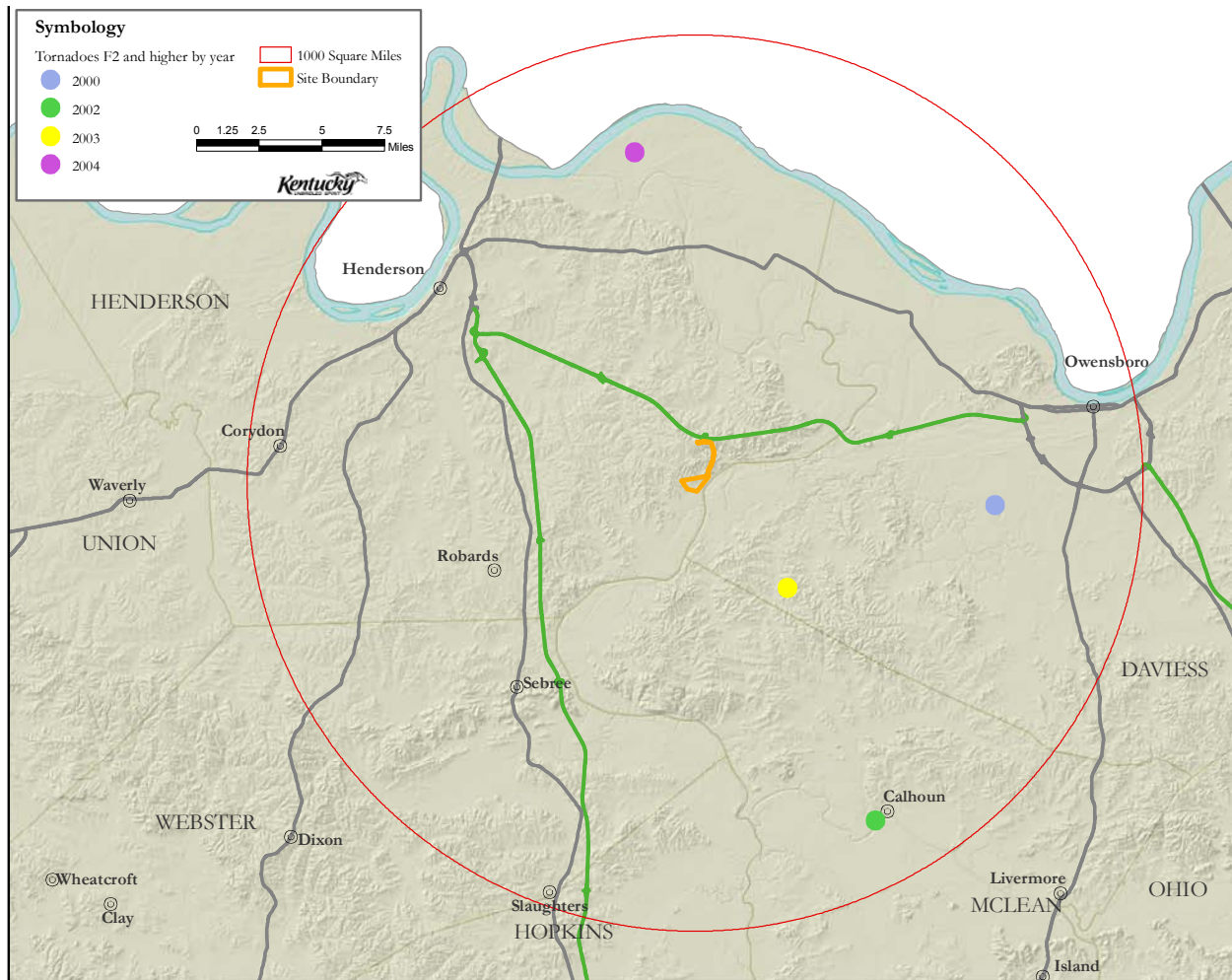
3.4. Exposure to Natural Hazards.

3.4.1. Hurricanes.

The proposed Henderson County FutureGen site does not pose an undue risk of damage due to hurricanes according to the U.S. Landfalling Hurricane Project.

3.4.2. Tornadoes.

Within the last five years, the proposed Henderson County FutureGen site has had 4 tornadoes F2 or higher/1000 square miles according to the National Climatic Data Center (NCDC).



3.5. Regulatory and Permitting.

3.5.1. State Environmental Policy Act (SEPA).

Kentucky does not have a statewide NEPA-type process. Therefore, the cabinet will accept the NEPA evaluation for the FutureGen plant as sufficient to meet the requirements under KRS 224.10-280. Kentucky does have similar processes for public notice for the wastewater and drinking water programs for permitting.

Under KRS 224.10-280(1) Electrical generating facilities that commence construction after April 15, 2002 are required to submit a fee and a Cumulative Environmental Assessment that addresses the issues in KRS 224.10-280 (3):

- (3) The cumulative environmental assessment shall contain a description, with appropriate analytical support, of:
 - (a) For air pollutants:
 - 1. Types and quantities of air pollutants that will be emitted from the facility; and
 - 2. A description of the methods to be used to control those emissions;
 - (b) For water pollutants:
 - 1. Types and quantities of water pollutants that will be discharged from the facility into the waters of the Commonwealth; and
 - 2. A description of the methods to be used to control those discharges;
 - (c) For wastes:
 - 1. Types and quantities of wastes that will be generated by the facility; and
 - 2. A description of the methods to be used to manage and dispose of such wastes; and
 - (d) For water withdrawal:
 - 1. Identification of the source and volume of anticipated water withdrawal needed to support facility construction and operations; and
 - 2. A description of the methods to be used for managing water usage and withdrawal.

KRS 224.10-280(2) states that:

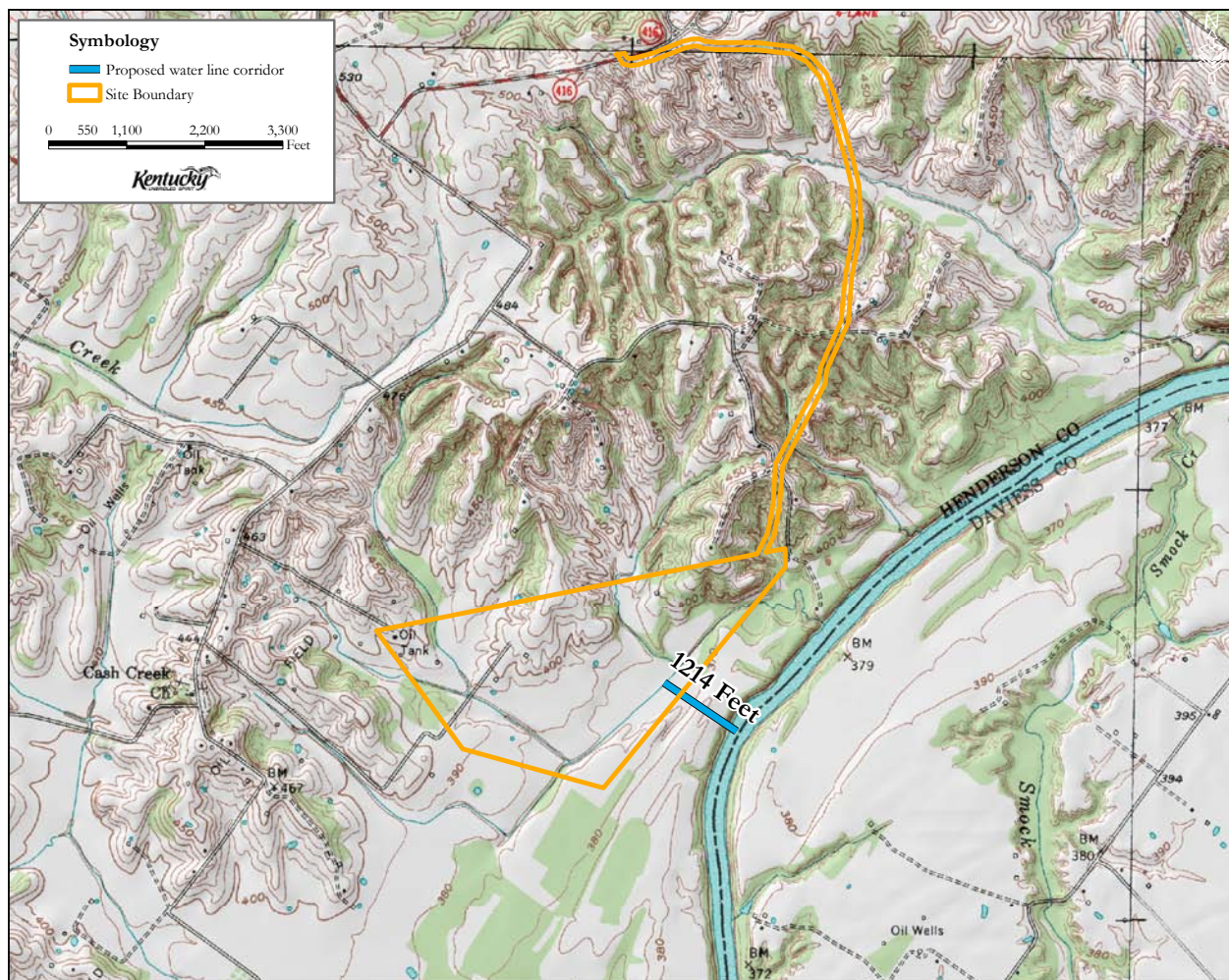
The person may submit and the cabinet may accept documentation of compliance with the National Environmental Policy Act (NEPA) as satisfying the requirements to file a cumulative environmental assessment under subsection (1) of this section. House Bill 665, passed by the 2006 General Assembly and signed by the governor exempts this facility from the Kentucky Electric Generation and Transmission Siting Board. See 3.5.1 Appendix for statutes.

3.6. Cooling Water.

3.6.1. Distance to Water Source.

The distance to the Green River, the readily available water source for cooling water, is approximately 1,214 feet from the southern boundary of the site. The Green River forms the second largest river basin in Kentucky with a total drainage area of 9,230 square miles. The proposed site drains approximate 8,700 square miles and produces an annual average flow of nearly 8-billion gallons of water per day.

The proposed use of the Green River will be subject to Kentucky water withdrawal permitting regulations (401 KAR 4:010). Standard criteria for a water withdrawal permit for the proposed site could allocate up to 185 million gallons per day (185 MGD) to a single user. A continuous withdrawal of 2,500 gallons per minute (3.6 MGD) for the FutureGen plant represents a minor allocation in this reach of the river and, as such, would be permitted with no conditions to limit withdrawals during periods of low flow. Because of the volume of water available from the Green River, no other source of cooling water is necessary.



3.6.2. Volume of Water Available.

The Green River is capable of supplying plant makeup requirements under the most extreme recorded drought conditions encountered in the basin. Withdrawal requirements for the FutureGen plant represent a minor allocation during drought conditions in this reach of the river and, as such, would be permitted with no conditions to limit withdrawals during period of low flow.

A water withdrawal permit can be developed to provide for the maximum-potential water requirements that are anticipated for this project. An approximate rate of 10 MGD (7,000 gpm) can be safely allocated with dependability since 10 MGD would be less than three (3) percent of the 7Q10 flow rate conditions.

Operational flexibility in meeting cooling-water requirements is assured with respect to the quantity of water available in excess of the normal operating amounts. The Green River forms the second largest river basin in Kentucky with a total drainage area of 9,230 square miles. The proposed site drains approximately 8,200 square miles and produces an annual average flow of nearly 8-billion gallons of water per day.

Flow in the Green River is regulated by the activities of four (4) U.S. Army Corps of Engineer (USACE) reservoirs in the basin. Prior to flow regulation, the 7Q10 at the proposed site was approximately 400 cubic feet per second (258 MGD). Since 1969 when the fourth USACE reservoir came online, the 7Q10 has risen to nearly 500 cubic feet per second (323 MGD).

3.7. Transmission.

3.7.1. Grid Proximity.

Kentucky's proposed site offers several options for interconnection to the grid and can access energy markets in the Midwest and Northeast as well as in the South-east.

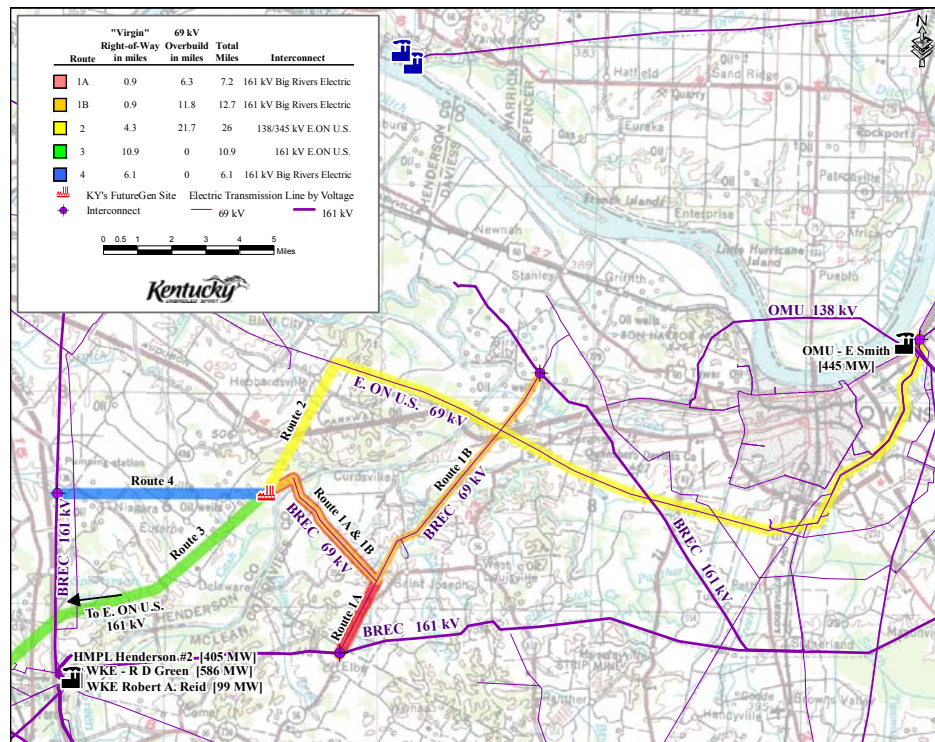
KRS 278.700 through 278.716 establishes the regulatory framework for siting electric transmission facilities that are not regulated by the Kentucky Public Service Commission. KRS 278.714 requires that a Certificate to Construct a nonregulated electric transmission line be obtained from the Kentucky State Board on Electric Generation and Transmission prior to construction.

The applicant must file an application that contains a description of the facilities and a map showing: the proposed transmission facilities; right-of-way limits; existing property lines; names of property owners over whose property the line will cross; and existing residential neighborhoods, schools, and parks within one mile of the proposed facilities. The applicant must file with his application a fee of \$50 per kilovolt of rated capacity per mile of length, except that the initial application fee shall not be less than \$10,000 nor more than \$200,000 per 807 KAR 5:100. See 3.7.1 Appendix for regulatory and statutory documentation.

The Board may hold a public hearing. The Board shall "...grant or deny the construction certificate either in whole or in part ... based on the board's determination that the proposed route of the line will minimize significant adverse impact on the scenic assets of Kentucky and the applicant will construct and maintain the line according to all applicable legal requirements." The board must issue its decision within 90 days after the application is filed if no public hearing is held or within one hundred twenty (120) days if a public

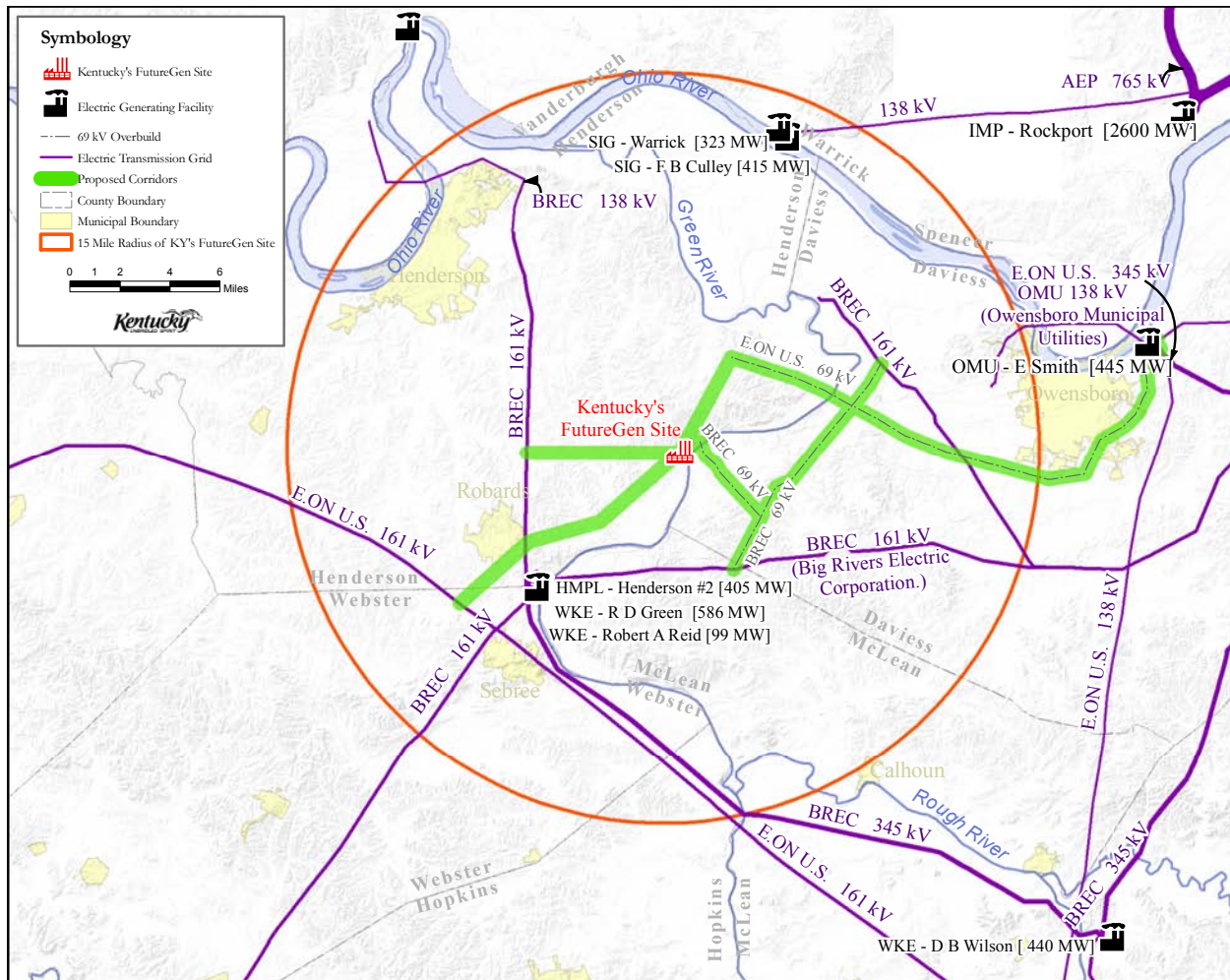
hearing is held. The purposes of this certification process are: to minimize the adverse impact to Kentucky's scenic assets; ensure lawful operation of the transmission facilities; and to allow for public input into the siting process.

No local approvals are required for electric transmission lines.



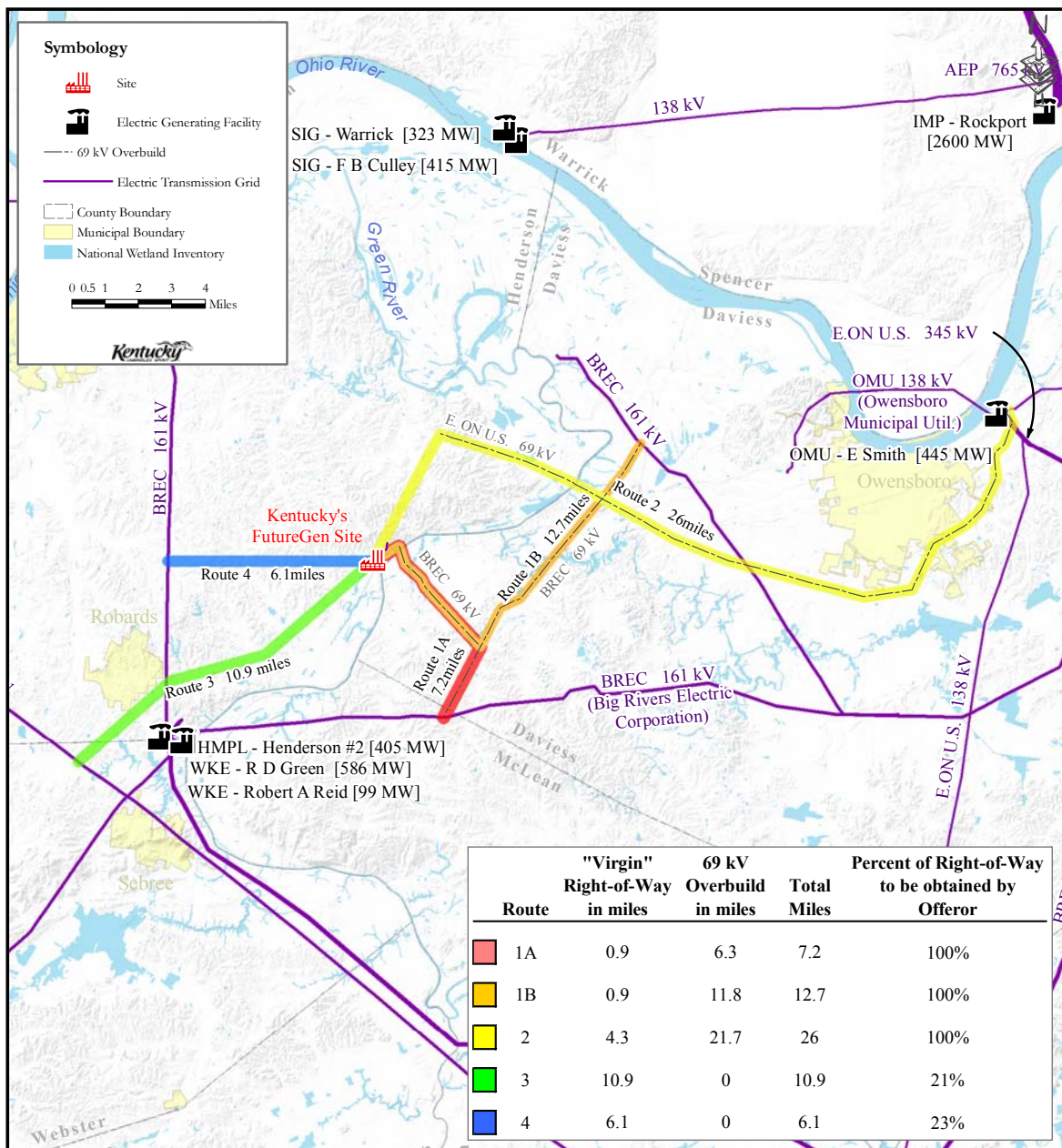
3.7.2. Voltage.

There are several higher voltage transmission lines within 15 miles of the Kentucky FutureGen site.



3.7.3. Rights-of-Way.

Kentucky's proposed site offers options for accessing Midwest, Northeast and Southeast markets. The map below shows several potential right-of-way corridors. Kentucky has an MOU with Penn Virginia operating company which owns 56,000 total acres, including 16,000 acres of surface property, making it one of the largest landowners in the vicinity (see 3.7.3 Appendix). The table indicates the percentage of virgin right-of-way that the offeror can obtain for each route. Routes 1a, 1b, and 2 utilize existing transmission rights-of-way while routes 3 and 4 are completely new routes.

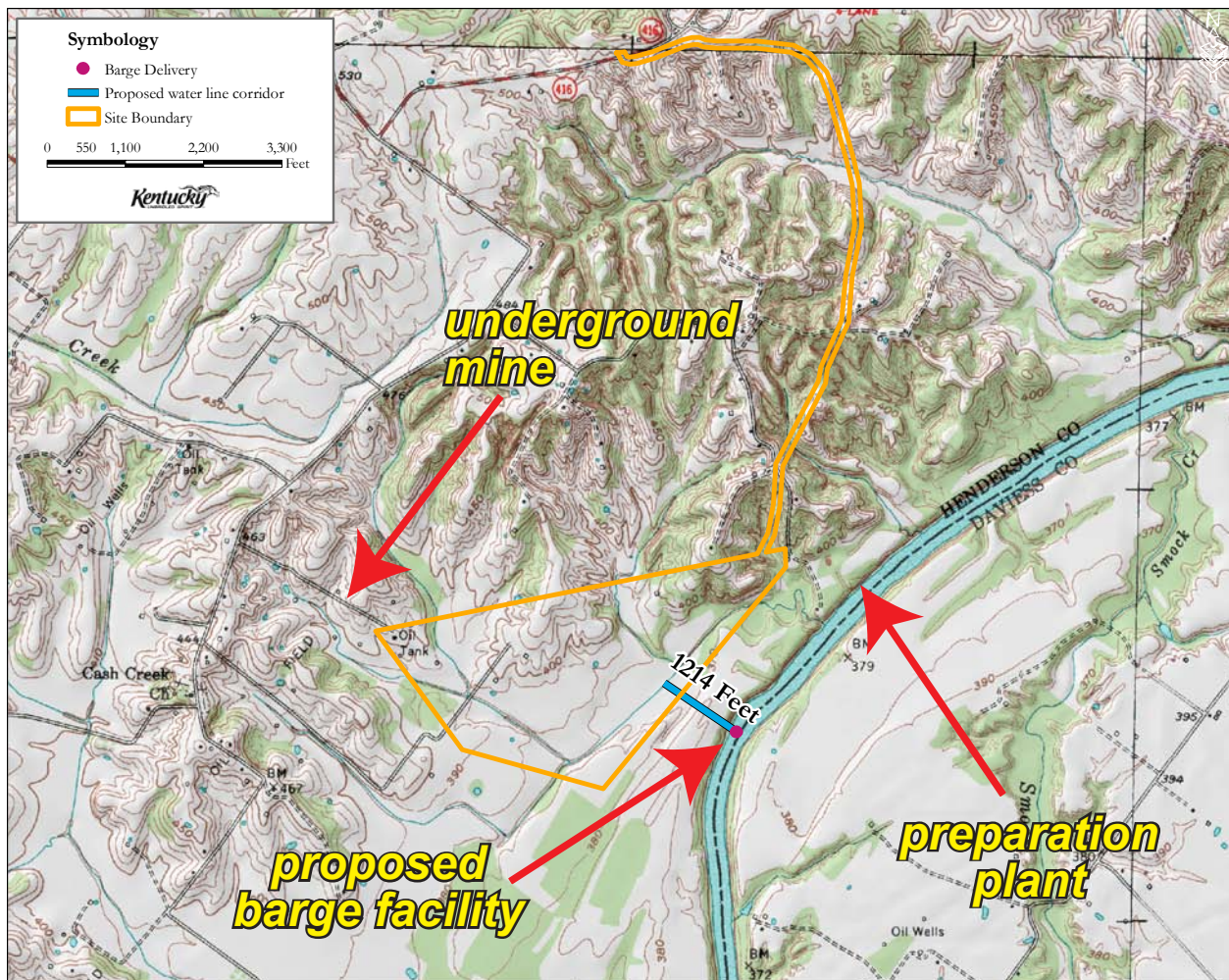


3.8. Material and Fuel Delivery.

3.8.1. Distance to Rail and/or Barge Delivery.

Delivery of fuel to the Kentucky FutureGen site will be by barge, truck or conveyor from the adjacent mine. Complex construction materials can be delivered by barge or truck. The CSXT railroad runs about 8.3 miles from the site. Because of the excellent river and highway networks serving the site, there currently is no plan to build a rail corridor to the site.

The map below shows the location of the barge facility that will be constructed on the Kentucky FutureGen site. There is an existing barge loadout at the adjacent preparation plant that gives the opportunity for shared barge fleeting areas.



3.8.2. Delivery Mode Flexibility.

Delivery of fuel to the Kentucky FutureGen site will be by barge, truck or conveyer from the adjacent mine complex. Construction materials can be delivered by barge or truck. The CSXT railroad is 8.3 miles from the site at its nearest point. Because of the excellent river and highway networks serving the site, there currently is no plan to build a rail corridor to the site. There is direct barge access or truck/rail/barge access throughout the West Kentucky coalfield and major parts of the rest of the Illinois Basin, the Central Appalachian Region, and the Western Region. The location of the Kentucky site near the center of the coal-producing areas of West Kentucky, Indiana, and Illinois and near the confluence of the Ohio and Green Rivers as well as the juncture of major highways, provides numerous alternative routes to the demonstrated reserve base of 133.6 billion tons and 70 mines with reserves at the mine of 1.5 billion tons and annual production of over 90 million tons. Railroads that serve the area around the site are the CSXT and the P&L; these interconnect to other major and short-line systems.

There is truck access to the Kentucky FutureGen site via numerous good quality roads. Major arterial highways near the site are the Pennyryle Parkway, Audubon Parkway, and U.S. Highway 41. U.S. Highway 41 also accesses the site from the Indiana coal fields and connects to Interstate 64 that traverses East/West through Indiana and Illinois.

Barge access to the Kentucky site provides access to coals in the Illinois Basin via direct barge carriage to the site and through truck to barge and rail to barge connections. In West Kentucky, 18 river terminals are open for use by any coal company and 7 are captive to a single company; there are 17 additional terminals in Indiana and Illinois. Barge service can also be utilized on the Ohio, Green, Mississippi, Tennessee, and Cumberland Rivers. The Tennessee River, as part of the Tenn -Tom Waterway provides access to foreign coal, as does the Mississippi/Ohio. There are four nearby terminals that provide rail to barge connections. These are the Henderson County Riverport, SCH Coal Terminal, and Grand Rivers Terminal in West Kentucky and the Mt. Vernon Coal Transfer Co., in Indiana. Up the Ohio River, the Jefferson

Riverport and the River Road Terminal, both at Louisville, provide truck, rail, and barge interconnection. Coals in the Central Appalachian Region are accessed by numerous river terminals, including 14 captive and one open-service terminal that serve Eastern Kentucky, primarily in the Big Sandy/Ohio River area. Western coals are accessed through rail-to-barge connections at St. Louis, Southern Indiana, and West Kentucky.

The terminals serving the Kentucky coalfields provide numerous combinations of owner or operating company; location; types of service (rail, truck, barge); connections with railroads; rail car and barge capacity; hourly and annual load out rates; storage; operational status; and blending, sampling, and crushing equipment.

The river system not only provides a low-cost means of transporting fuel and material into the site; it also offers low-cost transport of chemicals and other materials produced at the site. The Ohio River carries 150 million tons of cargo annually, including coal, rock, aggregate, chemicals, and fabricated materials. The Tenn-Tom Waterway which includes the Tennessee River, carries over 8 million tons of materials each year.

3.8.3. Access to Natural Gas Pipeline.

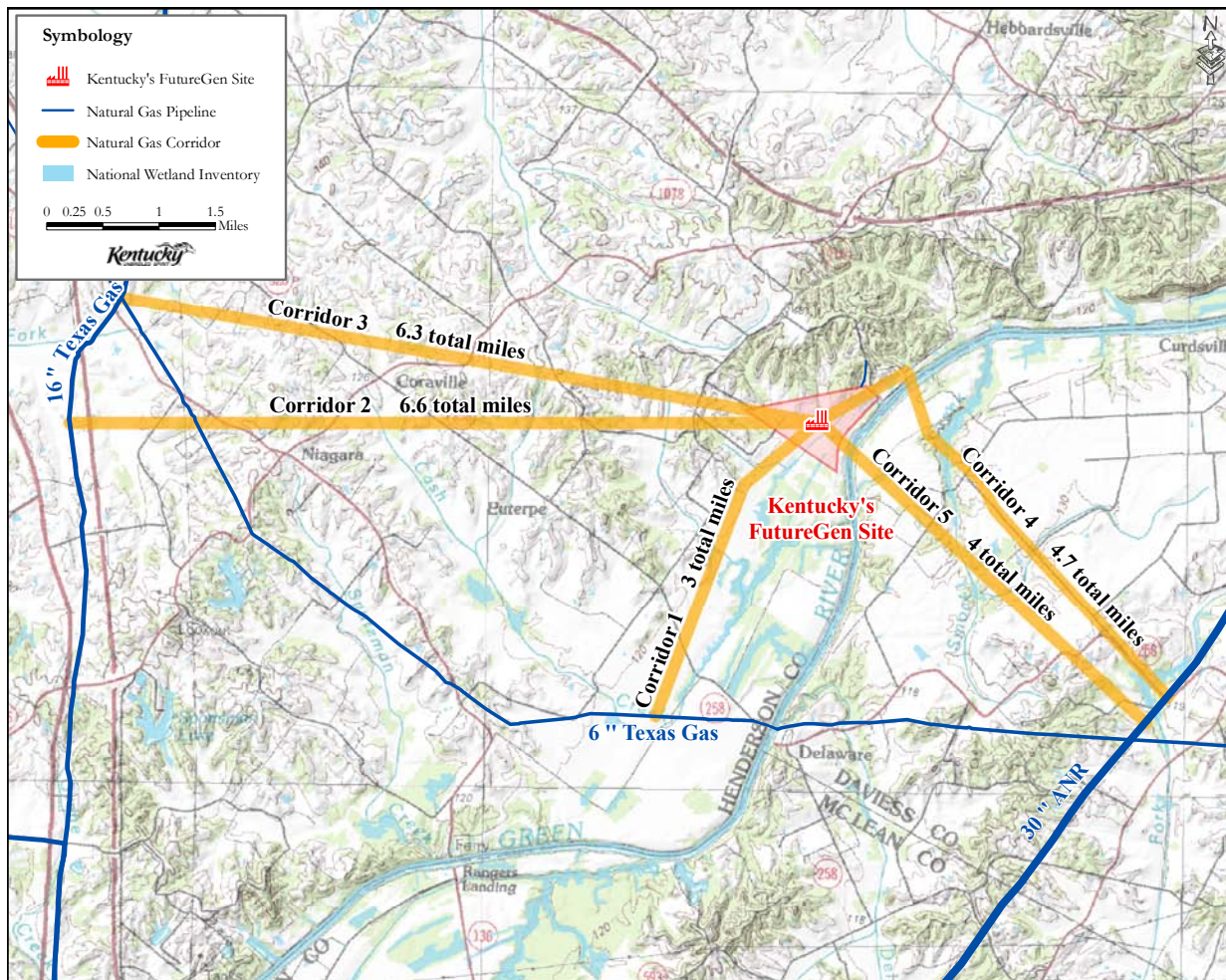
Kentucky's proposed site has access to two interstate natural gas transmission systems: Texas Gas and ANR.

Corridor 1 (see map below) connects to a 6 inch Texas Gas line that is able to deliver approximately 5,600 standard cubic feet per minute (SCFM) at 450 pounds per square inch (psi). The line could be up-rated to provide approximately 13,900 SCFM.

Corridor 2 and Corridor 3 connect to a 16 inch Texas Gas line that is able to deliver 30,000 SCFM at 450 psi. Corridor 2 is 6.7 miles long and is routed along a potential electric transmission corridor for this project. Corridor 3 is 6.3 miles long.

Corridors 4 and 5 connect to a 30" ANR line that is capable of providing 30,000 SCFM of natural gas at 450 psi. Corridor 4 is 4.7 miles long and parallels an existing electric transmission line. Corridor 5 is 4 miles long.

The offeror can provide approximately 2.4 miles of right-of-way for corridor 1, 1.5 miles of right-of-way for Route 2, 1.3 miles of right-of-way for corridor 3, 2.4 miles of right-of-way for corridor 4 and 0.4 miles of right-of-way for corridor 5.



3.9. Availability of Workforce.

3.9.1. Construction Labor Availability.

Nearest Population Centers

City	2004 Census Population Estimate	Distance From Site
Henderson, KY	27,574	15 miles
Owensboro, KY	54,900	25 miles
Evansville, IN	117,156	24 miles

Kentucky's workforce is more productive than the U.S. average, producing almost two percent (1.91%) more output per dollar in wages than the U.S. average. Kentucky ranks 23rd among the 50 states in Gross State Product (GSP) per Wage.

State and local training resources can provide entry-level job training and skills upgrading for virtually any industrial occupation or skill. The Bluegrass State Skills Corporation (BSSC) works in partnership with other employment and job training resources and programs to package a program customized to meet the specific needs of a company. Funds can be provided for sending company trainers out of state for specialized company training.

The strength of these programs is demonstrated by Expansion Management magazine's October 2005 Workforce Training Ranking. Kentucky's Workforce Training Programs, which includes the Bluegrass State Skills Corporation (BSSC), ranked 3rd in the U.S. For the 3rd consecutive year, Kentucky has ranked in the Top Ten, placing 5th in 2004 and 8th in 2003. The ranking considered the programs' efforts in facilitating customized business and industry training services for new, expanding and existing companies. Information provided by the Kentucky Cabinet for Economic Development, March 2006. Additional information can be found in 3.9.1 Appendix.

3.9.2. Operations Labor Availability.

Nearest Population Centers

City	2004 Census Population Estimate	Distance From Site
Owensboro, KY	54,900	25 miles
Evansville, IN	117,156	24 miles

Additional information can be found in 3.9.2 Appendix.

3.9.3. Construction Cost.

The City Cost Index for Henderson, KY is 91.3

The City Cost Index for the U.S. 30-city average is 100.0

Types of buildings used to calculate the City Cost Indexes are:

- Factory, Office, Retail Store, Town Hall, High School, Hospital, Parking Garage, Apartment, and Hotel/Motel.

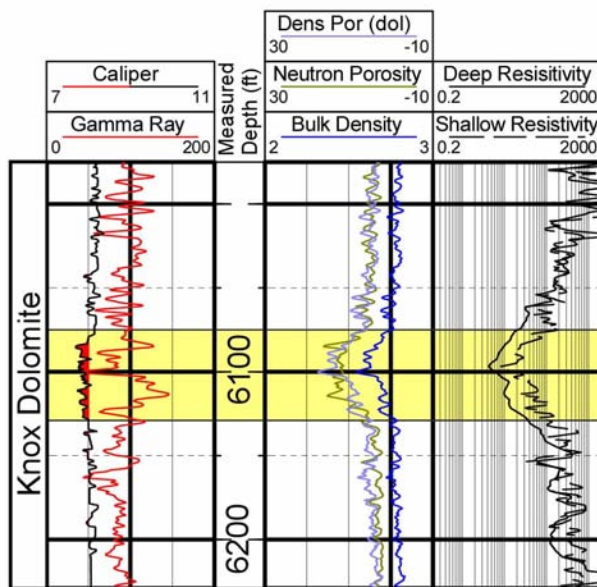
Source: Building Construction Cost Data – 64th Annual Edition 2006, published by RSMeans, Kingston, Massachusetts.

PART 4--Geologic Storage Scoring Criteria

4.1. Formation Properties

4.1a.1. Proposed Target Formation— Cambro-Ordovician Knox Supergroup (Primary).

The Cambro-Ordovician Knox Supergroup will meet the storage criteria of 100% of 50 million metric tonnes of CO₂ injected and is the injection target proposed for the Henderson County site. To demonstrate the diversity of CO₂ trapping mechanisms available at the site, the Devonian New Albany Shale is proposed as an alternate target. The Knox is a regionally extensive and thick dolomite, with well-developed porosity zones common throughout the state. Kentucky's only waste injection wells are in the Knox. The Dupont wells (148 km, 92 miles from site) injected liquid wastes into vuggy to cavernous Knox porosity zones, at depths of 960 to 1,006 m (3,150 to 3,300 ft). The IMCO Recycling well in Butler County (82 km, 51 miles from site) injects liquid wastes into a Knox vuggy porosity zone, at a depth of 1,966 m (6,450 feet). Two gas storage fields are also located in the Knox. The Eagle Creek Gas Storage Field is at a depth of 247



Texas Gas 1A Kerrick: Knox Zone

to 324 m to (812 to 1,064 feet) and the Ballardville Field (abandoned) is at 383 m (1,255 feet). Both fields are in vuggy porosity reservoirs in the upper part of the unit. Knox carbonates are also prolific hydrocarbon producers on the Cincinnati Arch, 161 km (100 miles) to the east. In many fields, dense carbonates in overlying or lateral Knox carbonates, or carbonates above the unconformity surface at the top of the Knox provide seals for stratigraphic traps.

The Knox porosity zone in the Texas Gas 1A Kerrick well (17.7 km, 11 miles away) is 24 m (79 feet) thick, but net porosity feet above 4% is 16.5 m (54 feet). Mean density porosity is 9.3% (range 4 -17%). The higher

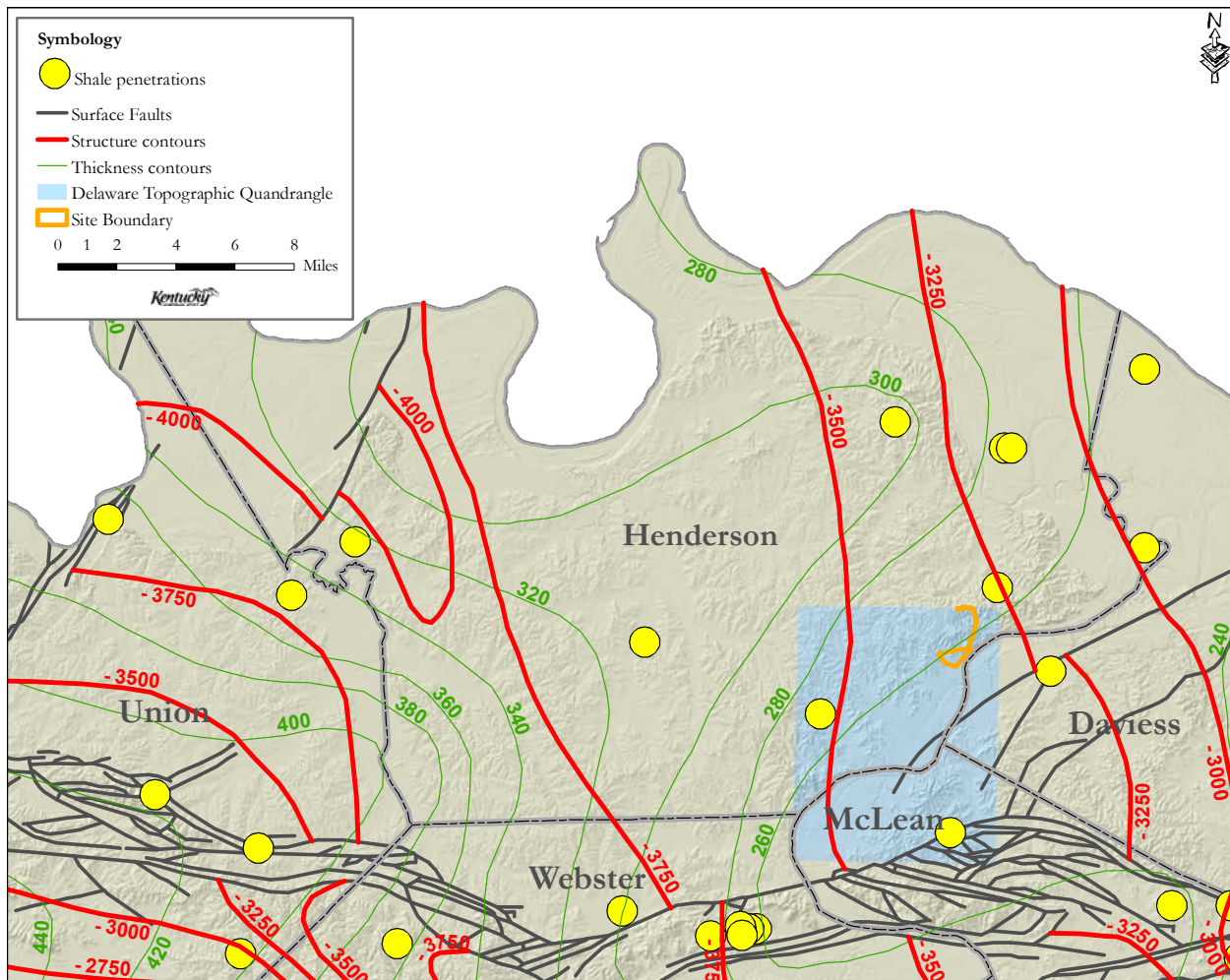
radioactivity on the gamma ray log in the lower part of the zone is not thought to be due to increased shale. The corresponding neutron, resistivity, and caliper logs show similar porosity and permeability as the upper part of the zone, suggesting the gamma ray response is due to radioactive dolomite.

4.1b.1. Proposed Target Formation—Devonian New Albany Shale.

The Devonian New Albany Shale is an alternate injection target at the Henderson County site. The New Albany is an organic shale 1,250 meters (4,100 ft) above the primary Knox target. This formation can support at least 25% of the capacity required. At the site, the shale occurs below approximately 1,067 meters (3,500 ft) in depth with an average thickness of 80 meters (262 ft). The shale unconformably overlies Middle Devonian carbonates and is conformably overlain by the Mississippian New Providence Shale. The New Albany is essentially flat throughout Henderson County dipping at about 0.5 degrees to the west. The shale is a known gas resource in the Illinois Basin and produced approximately 1 billion cubic feet of gas in 2004 from Meade, Grayson, Butler, and Edmonson Counties.

Adapted from Hasenmueller and others, 2000, GIS Compilation of Gas Potential of the New Albany Shale in the Illinois Basin: Gas Research Institute, Chicago, GRI-00/0068, CD-ROM.

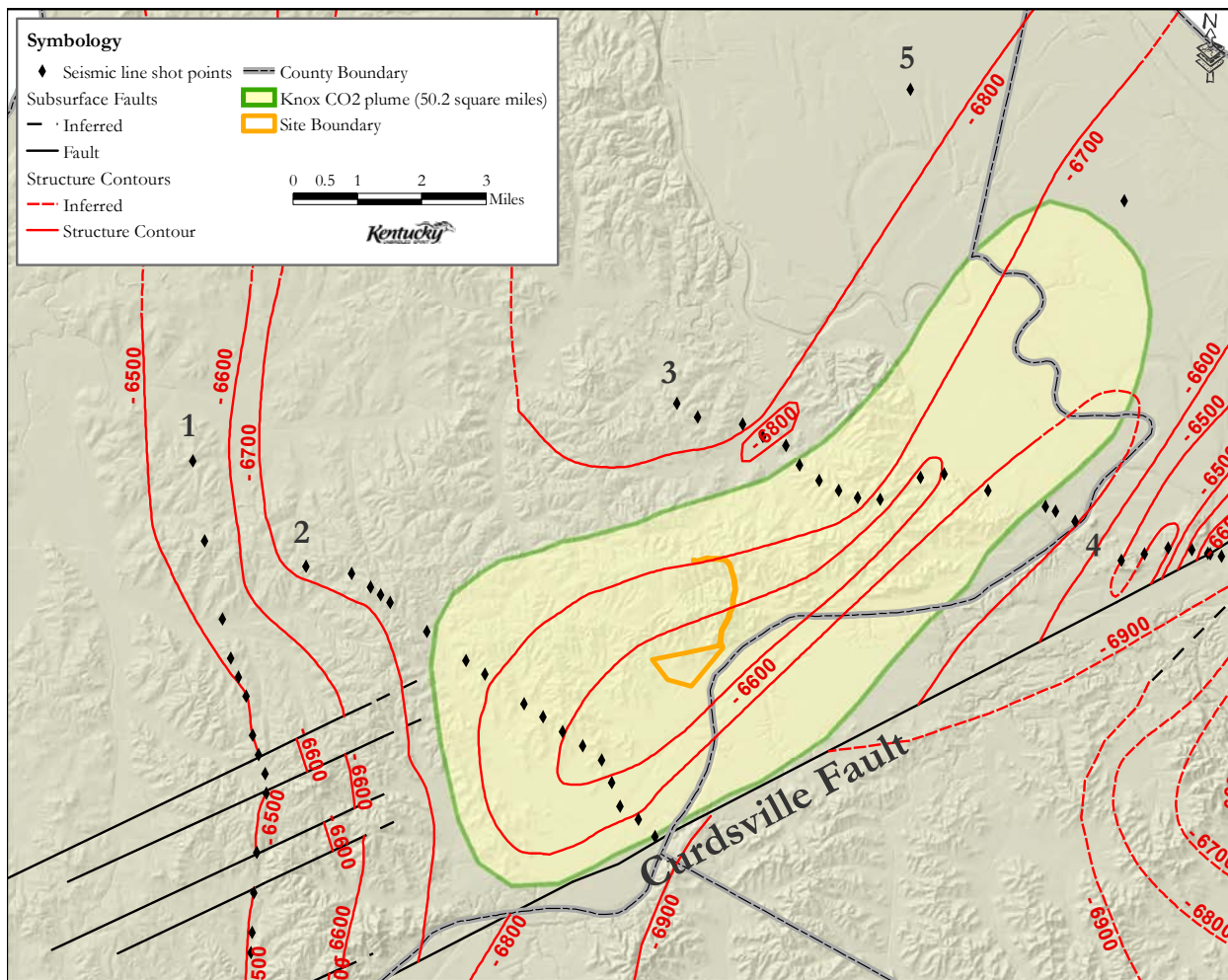
Structure and Thickness of New Albany Shale



4.1a.2. Orientation—Cambro-Ordovician Knox Supergroup (Primary).

There are few wells to the Knox Supergroup in the area and previous structure maps have been based on widely scattered wells. Regional structure suggests a generally updip orientation to the east similar to the shallower New Albany Shale.

A new detailed structure map based on analyses of five reflection seismic profiles (numbered 1-5 in the map below) in and near the proposed site indicates a northeast-oriented elongate dome that is subparallel to the Curdsville Fault (also with a NE trend) with between 15 and 30 m (50 and 100 feet) of closure on the top of the Knox Supergroup. This structure is similar in orientation to a small anticline noted on the Pennsylvanian Springfield coal at much shallower depths (see section 2.6.4) on the Delaware 7.5-minute Quadrangle (Johnson, 1973), suggesting that it influences strata to the surface. We infer that the porosity zone 137 m (450 feet) below the top of the Knox would also be influenced by the structure. The structure that is inferred should prevent regional undip migration of CO₂.



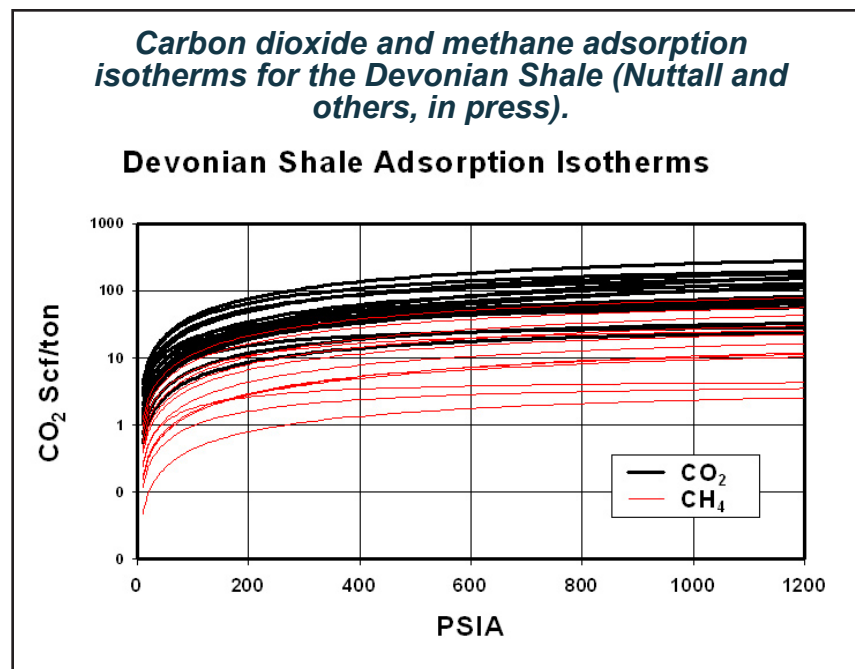
Reference

Johnson, W.D., Jr., 1973, Geologic map of the Delaware quadrangle, Western Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ-1087, scale

4.1b.2. Orientation—Devonian New Albany Shale.

In organic-rich, fractured shales, gases are expected to occur in three main states: as free gas in fractures; as gas dissolved in water filling the fractures; and, as gas adsorbed primarily on the dispersed organic matter in the shale matrix. These same options for storage of injected CO₂ have been identified in coals. CO₂ injected into the New Albany Shale is expected to migrate through the fracture system and diffuse into the shale matrix where it will be sorbed onto the organic matter (and possibly clay minerals) for permanent storage. If present, water in the fracture system will likely tend to hydrostatically confine plume migration. In general, CO₂ is expected to be stored in shales primarily in a non-migratory, adsorbed state, and the orientation of any free gas plume is expected to align along the orientation of major fracture systems in the area.

Measurements of the regional in situ compressive (tectonic) stress field in Western Kentucky indicate a dominantly horizontal, N80°E to east-west orientation (Zoback and Zoback, 1980; Nelson and Bauer, 1991), which is why roof falls in underground mines were historically greatest in N-S and E-W oriented passages. Based on this information and the low westward dip of the New Albany Shale, any migration of free CO₂ in the fracture system is expected to occur in a generally northeastward direction from the site.



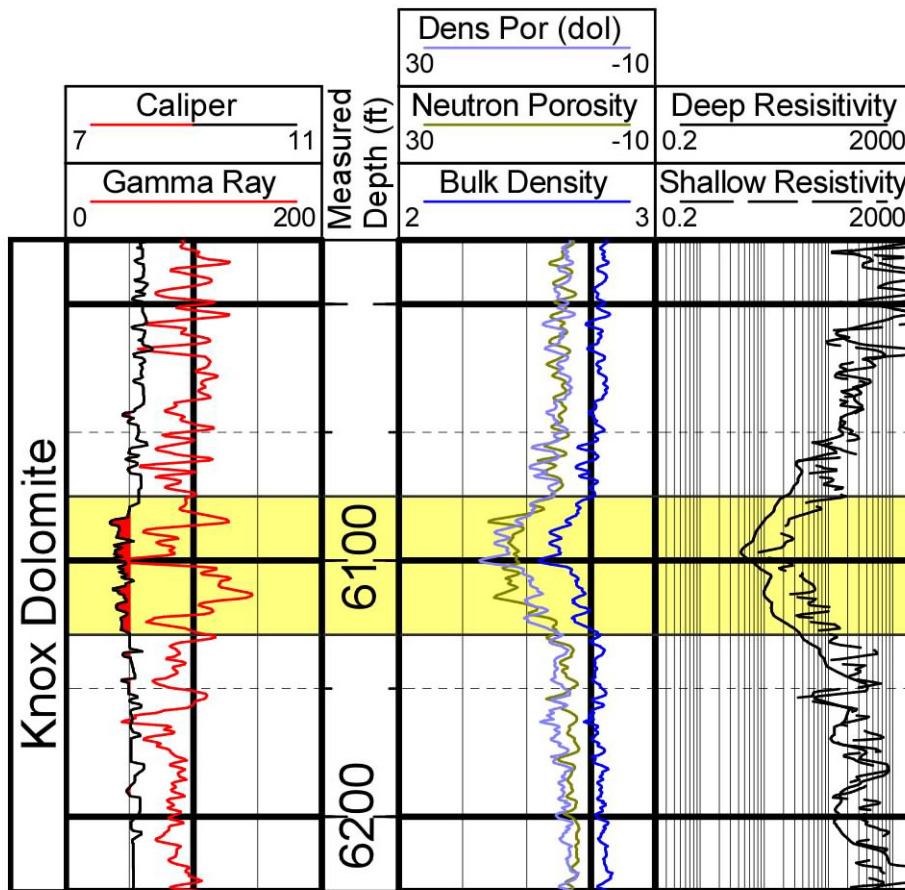
References

- Nelson, J.W., and Bauer, R.A., 1991, Coping with tectonic stress in the Illinois Basin coal field, in Peters, D.C., ed., *Geology in Coal Resource Utilization*: Fairfax, Virginia, Techbooks, American Association of Petroleum Geologists, p. 321-335.
- Nuttall, B.C., Eble, C.F., Drahovzal, J.A., and Bustin, R.M., in press, Analysis of Devonian Black Shales in Kentucky for Potential Carbon Dioxide Sequestration and Enhanced Natural Gas Production: Kentucky Geological Survey, URL <http://www.uky.edu/KGS/emsweb/devsh/devshseq.html>, visited 22-Feb-2006.
- Zoback, M.L., and Zoback, M., 1980, State of stress in the conterminous United States: *Journal of Geophysical Research*, v. 85, p. 6113-6165.

4.1a.3. Permeability—Cambro-Ordovician KnoxSupergroup (Primary).

The Knox Supergroup porosity zone in the Texas Gas 1A Kerrick well (17.7 km, 11 miles away, see map section 2.4.3) is 24 m (79 feet) thick, but net porosity feet above 4% is 16.5 m (54 feet). Mean density porosity is 9.3% (range 4 to 17%). There is mud cake indicated on the caliper log (under-gauge hole size is shaded red in the figure below), which indicates infiltration of drilling mud into a permeable zone. Separation on the resistivity curves with the deeper resistivity (solid) being lower than the shallow (dashed) resistivity curve also indicate invasion of lower salinity drilling fluid into the formation and permeability, although no quantitative data is available.

The nearest core with permeability analyses is the Dupont injection well in Louisville, Kentucky (148 km, 92 miles to the east). Permeability from core in porosity zones in that well range from 632 to <1 md, but the average of values at 90 degrees to the maximum horizontal permeability range yields 60.0 md, which is the value used for the Henderson County site evaluation. Calculations in section 2.5.1 show that the Knox is capable of meeting 100% of the injectivity and capacity requirements. A conservative Knox matrix permeability value was used in our injection model. In the Dupont wells and other producing zones, the Knox zone is characterized by a dual porosity system with



fracture or vuggy porosity contributing to significantly higher effective permeability. In this case, a single porosity model with a lower permeability was used. While a dual porosity system would have much higher permeability and injection rates, the resultant CO₂ plume would differ in size and lateral extent from that modeled in the single porosity model.

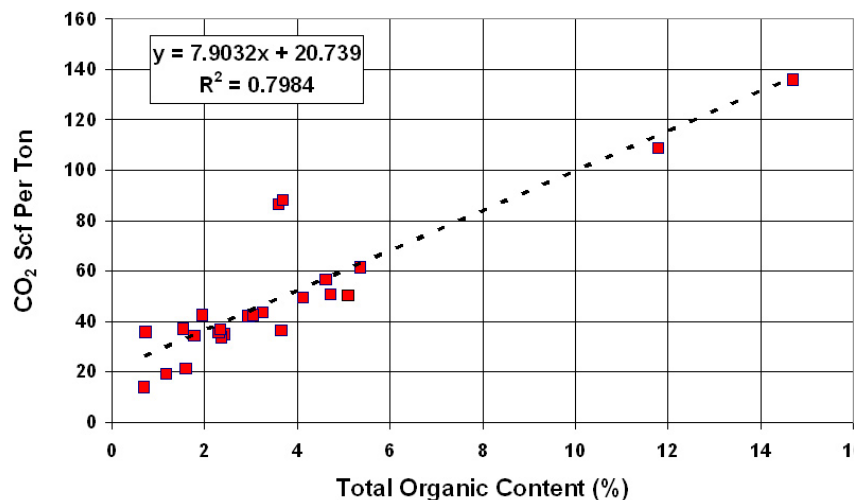
Texas Gas 1A Kerrick: Knox Zone

4.1b.3. Permeability—Devonian New Albany Shale.

The New Albany is a regionally continuous, low permeability shale. Permeabilities are likely in the range of 0.1 millidarcy to 0.5 microdarcies. Permeability, however, does not have the same relationship to reservoir quality in organic shales as it does in a sandstone or carbonate reservoir. The primary gas storage mechanism in the New Albany Shale is adsorption. That is, CO₂ is expected to be trapped in a near-liquid density monolayer coating the intragranular porosity associated with organic matter. Methane and adsorption isotherm data gathered for the shale (Nuttall and others, in press) indicate a 5.3 to 1 ratio of CO₂ to CH₄ in the shale and determined a direct relationship between total organic carbon content (TOC) and the amount of sorbed CO₂ that can be stored by the shale.

Graph showing relationship between total organic content and CO₂ adsorption capacity (tons)

Devonian Shale Adsorption at 400 PSIA



Where the shale is not sufficiently organic-rich or fractured to be a gas producer and injection target, the unit's low permeability and adsorptive qualities make it a regional seal for any deeper sequestration targets.

Reference:

Nuttall, B.C., Eble, C.F., Drahovzal, J.A., and Bustin, R.M., in press, Analysis of Devonian Black Shales in Kentucky for Potential Carbon Dioxide Sequestration and Enhanced Natural Gas Production: Kentucky Geological Survey, URL <http://www.uky.edu/KGS/emsweb/devsh/devshseq.html>, visited 22-Feb-2006.

4.1a.4. Capacity—Cambro-Ordovician Knox Supergroup (Primary).

The Alliance suggested that well data within 10 miles (16 km) of the proposed injection wells be used in compiling capacity estimates. The closest data to the site is 11 miles (17.7 km). However, the Knox Supergroup is a regionally continuous unit known to extend below the site. It serves as an injection zone and producing reservoir in Central Kentucky and Southern Indiana. The following capacities and plume size were calculated with the Excel spreadsheet provided with the RFP.

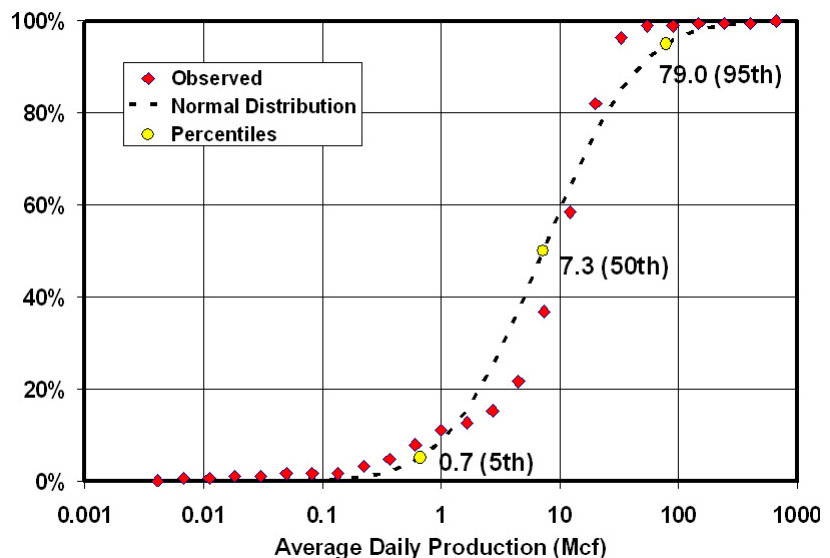
4.1a.4 Cambro-Ordovician Knox Supergroup 100% of 50MMT=50 MMT		
Input Parameters	Value	Unit
Formation Depth	2249	meters
Formation Thickness	16.5	meters
Effective Porosity	9.3%	
Temperature	54	C
Dissolved NaCl	5.7	molal
Percentage of Injection	100%	
Calculated Parameters		
Formation Pressure	2.20E+07	Pa
CO ₂ Density	7.83E+02	kg/m3
CO ₂ Fugacity Coefficient	4.09E-01	
CO ₂ Henry's Constant	1.11E+09	Pa
CO ₂ Aqueous Mass Fraction	1.98E-02	kg/m3
Aqueous Density	1.2E+03	kg/m3
Water Content	6.5%	
Fixed Parameter		
Mass of Injected CO ₂	5.00E+07	tonnes
Results		
Formation Supercritical CO ₂ Capacity	2.18E+01	kg/m3
Formation Dissolved CO ₂ Capacity	1.54E+00	kg/m3
CO ₂ Plume Areal Extent	129.6	km2
CO ₂ Plume Volume	2.1	km3
Areal Extent:	50.05762	sq mi
	32036.87	acres

Calculations were made that demonstrate the Knox is capable of sequestering 100 million metric tonnes of CO₂. The New Albany Shale is discussed to demonstrate the diversity of trapping mechanisms that exist at the Henderson County site. Other potential storage zones not formally evaluated for this report include the Mississippian McClosky carbonates (miscible enhanced oil recovery), Ordovician St. Peter Sand (saline aquifer), and Cambrian Mt. Simon Sand (saline aquifer).

4.1b.4. Capacity—Devonian New Albany Shale.

The New Albany Shale is an unconventional reservoir that will store CO₂ as adsorbed gas. Given sufficient areal extent, tremendous storage volumes are possible. The estimated potential total sequestration capacity of the shale in Henderson County, Kentucky exceeds 500 million metric tonnes. This provisional estimate assumes a storage capacity of 1.2 cubic meters (40 standard cubic feet) of CO₂ per ton of shale (at 2.8 megapascals, 400 psia) and is based on CO₂ adsorption isotherm data collected from four New Albany Shale samples in Indiana and Eastern Kentucky data (Nuttall and others, in press). At 50 percent efficiency, the indicated storage capacity of the shale is 64 metric tonnes of CO₂ per hectare-meter of shale (8.71 U.S. tons of CO₂ per acre-foot of shale). These data represent a theoretical estimate of the amount of CO₂ that could be confined as adsorbed gas in the shale matrix at the stated pressure. The actual amount of storage will depend on reservoir pressure and temperature, injection pressure and flow rate, diffusivity of CO₂ and CH₄ through the shale, organic matter content, and gas storage efficiency. These data must be refined for the study area.

Injectivity data for the shale are generally not available. In the absence of such data, injectivity was estimated based on natural gas production rates. Injection rates are expected to be at least the current rate of production and will not exceed rates (pressures) that will induce fracturing of the shale. The rate must also be modified based on the preferential adsorption rate of CO₂ versus CH₄. Data from Nuttall and others (in press) indicate this preferential adsorption rate to be 5.3 volumes of CO₂ to one volume of CH₄. Under these assumptions, available natural gas production rate data indicate the injectivity for an individual well is estimated to be from 2 to 22 metric tonnes per day.



Reference:

Nuttall, B.C., Eble, C.F., Drahovzal, J.A., and Bustin, R.M., in press, Analysis of Devonian Black Shales in Kentucky for Potential Carbon Dioxide Sequestration and Enhanced Natural Gas Production: Kentucky Geological Survey, URL <http://www.uky.edu/KGS/emsweb/devsh/devshseq.html>, visited 22-Feb-2006.

4.1a.5. Plume Size—Cambro-Ordovician Knox Supergroup (Primary).

Plume size for the Knox Supergroup injection zone was calculated from the spreadsheet supplied with the RFP, using parameters discussed in previous sections. These calculations indicate a plume size of 50.1 square miles for 50MM tonnes of CO₂.

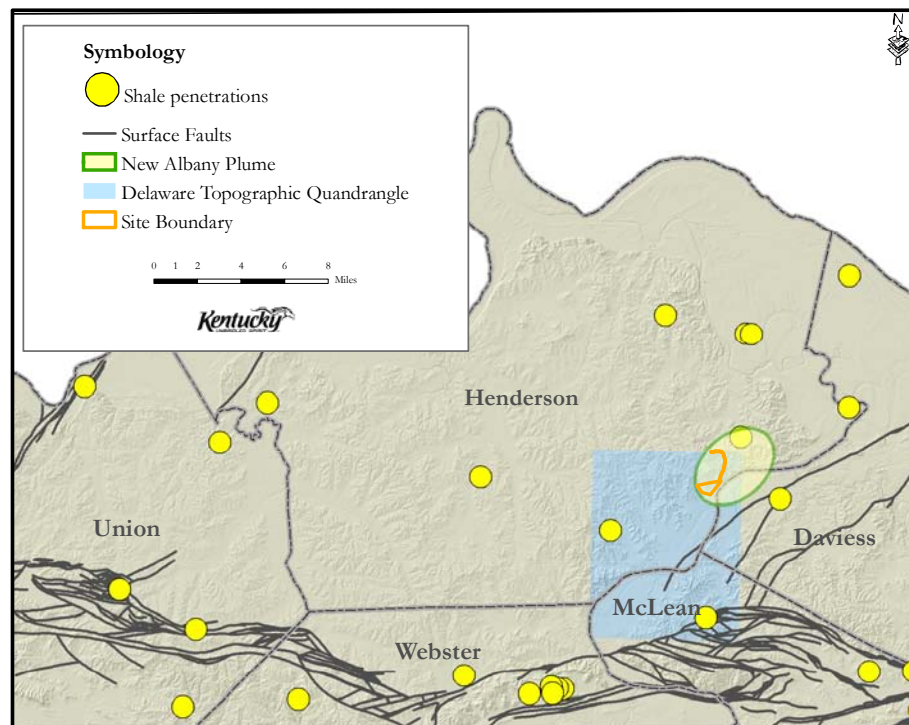
Cambro-Ordovician Knox Supergroup CO₂ Plume Calculations

4.1a.5 Cambro-Ordovician Knox Supergroup 100% of 50MMT=50 MMT		
Input Parameters	Value	Unit
Formation Depth	2249	meters
Formation Thickness	16.5	meters
Effective Porosity	9.3%	
Temperature	54	C
Dissolved NaCl	5.7	molal
Percentage of Injection	100%	
Calculated Parameters		
Formation Pressure	2.20E+07	Pa
CO ₂ Density	7.83E+02	kg/m3
CO ₂ Fugacity Coefficient	4.09E-01	
CO ₂ Henry's Constant	1.11E+09	Pa
CO ₂ Aqueous Mass Fraction	1.98E-02	kg/m3
Aqueous Density	1.2E+03	kg/m3
Water Content	6.5%	
Fixed Parameter		
Mass of Injected CO ₂	5.00E+07	tonnes
Results		
Formation Supercritical CO ₂ Capacity	2.18E+01	kg/m3
Formation Dissolved CO ₂ Capacity	1.54E+00	kg/m3
CO ₂ Plume Areal Extent	129.6	km2
CO ₂ Plume Volume	2.1	km3
Areal Extent:	50.05762	sq mi
	32036.87	acres

4.1b.5. Plume Size—Devonian New Albany Shale.

The New Albany Shale is not expected to be the primary target for CO₂ sequestration at the proposed Henderson County site. To estimate maximum plume size, however, calculations were made assuming that 12.5 million metric tonnes of CO₂ (25 percent of the proposed 50 million tonnes of CO₂) were to be stored in the shale. The Excel spreadsheet, CO₂_Plume_Extent_lock.xls, was initially used for the calculations. The spreadsheet assumes that CO₂ will be stored as a supercritical fluid occupying all available porosity in the target unit with some consideration given to the solubility of CO₂ in formation waters. The model ignores storage of CO₂ as adsorbed gas and mineral trapping. A plume size estimate will be derived from adsorption isotherm data from Nuttall and others (in press) and geophysical log data available for nearby shale penetrations. Adsorbed gas is relatively immobile. Any CO₂ injected into the shale is not expected to undergo significant migration.

Plume size calculations were made based on a conservative average CO₂ adsorption value of 40 standard cubic feet of CO₂ per ton of shale. The estimated plume area representing storage of 12.5 million metric tonnes of CO₂ injected into the shale at a pressure of 2.8 megapascals (400 psia) with 50 percent storage efficiency would have an area of 24.6 km² (9.5 mi²). At this efficiency, 64 metric tonnes of CO₂ could be stored per hectare-meter of shale (8.71 U.S. tons of CO₂ per acre-foot of shale). The plume orientation is expected to align with the regional stress field. This plume will be above and completely within the area of the CO₂ plume determined for the primary sequestration target, the Cambro-Ordovician Knox Supergroup.



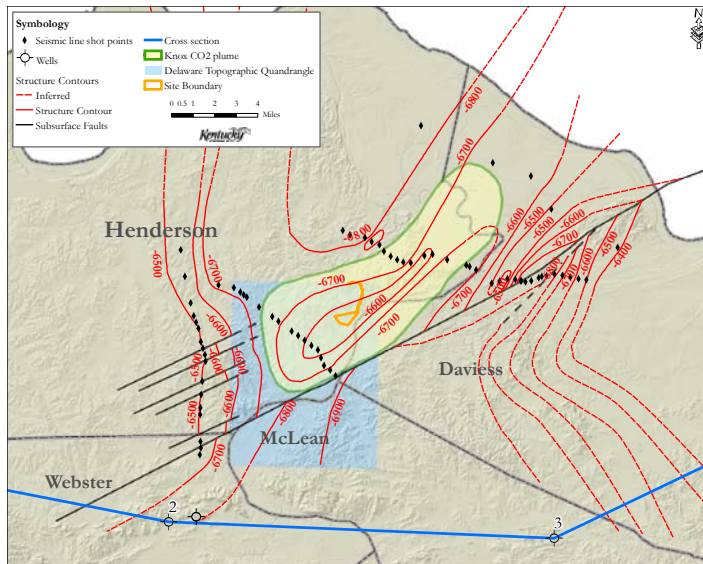
Reference:

Nuttall, B.C., Eble, C.F., Drahovzal, J.A., and Bustin, R.M., in press, Analysis of Devonian Black Shales in Kentucky for Potential Carbon Dioxide Sequestration and Enhanced Natural Gas Production: Kentucky Geological Survey, URL <http://www.uky.edu/KGS/emsweb/devsh/devshseq.html>, visited 22-Feb-2006.

4.2. Seals

4.2a.1. Faults—Cambro-Ordovician Knox.

There are no active or known transmissive faults that intersect the primary seal. Kentucky is one of the few states that has been completely geologically mapped at 1:24,000 scale, and as a result, Kentucky has more accurate fault coverage than most states. One fault, the Curdsville fault, just southeast of the proposed site was inferred beneath alluvium on the Delaware quadrangle (Johnson, 1973). The fault is also confirmed on the reflection seismic data interpreted for this project, including one line cross-



ing the site. The fault is oriented NE-SW and is downthrown to the SE. Maximum offset at the top of the Knox is estimated to be 30 m (100 feet) east of the site and 46.1 m (150 feet) to the northeast. Due to the fact that the Curdsville fault dips to the southeast, its subsurface location is displaced in that direction at the Knox horizon. The maximum fault displacement of 150 feet is less than the thickness of the Maquoketa Shale (430 feet), indicating there is continuity of the primary seal across the fault.

There is no quantitative data indicating whether the Curdsville fault is transmissive or sealing. There are oil fields on both sides of the fault that are apparently sealed with no reported hydrocarbon leaks or seeps along the fault at the surface, implying that the fault is a sealing fault. More importantly, within ductile shale intervals like the Maquoketa, the fault zone is characterized by clay fault gouge, creating a barrier to fluid flow. This fault is not seismically active.

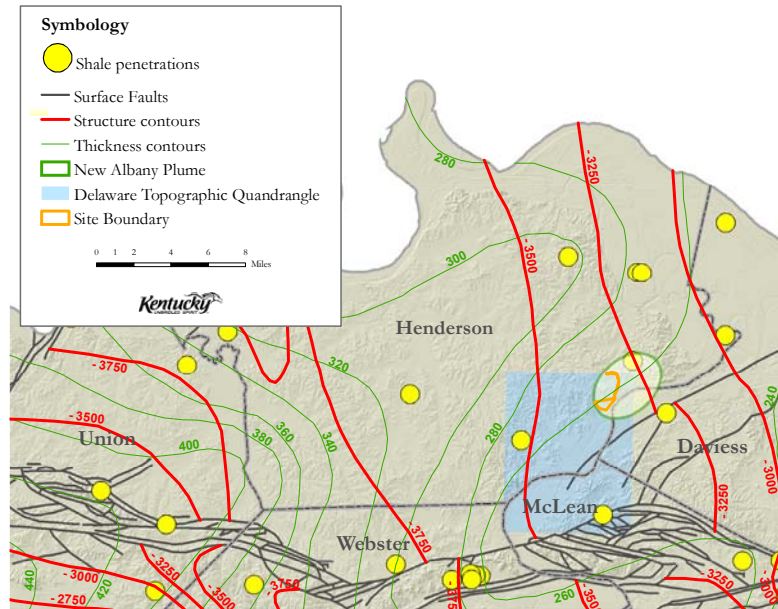
Reflection seismic data also show a series of small, fault-bounded grabens oriented sub-parallel to the Curdsville fault, 8.3 km (4.9 miles) south of the site. These faults were not mapped at the surface (Johnson, 1973). They were interpreted only on seismic line 1 and do not occur on line 2 that is nearer to the site. Offset is estimated to be less than 15 m (50 feet) on individual faults. These faults are not seismically active and there is no evidence that they are transmissive.

The seal capacity of faults in the area is also indicated by a successful secondary oil recovery project using mixed nitrogen/CO₂ gas injection into a shallow Pennsylvanian sandstone reservoir in adjacent Union County (Duchscherer, 1965). The Spring Grove pool in this example is a structural closure trapped by the Rough Creek fault zone, which is similar in age and tectonic style to the Curdsville fault. Gas injection of 240,000 SCFD resulted in a 5-fold increase in oil production with no reports of fault seal problems.

A list of references can be found on 4.2a.1.

4.2b.1. Faults—Devonian New Albany Shale.

There are no active or known transmissive faults that intersect the primary seal. Kentucky is one of the few states that has been completely geologically mapped at 1:24,000 scale, and as a result, Kentucky has more accurate fault coverage than most states. One fault, the Curdsville fault, just southeast of the proposed site was inferred beneath alluvium on the Delaware quadrangle (Johnson, 1973). The fault is also confirmed on the reflection seismic data interpreted for this project, including one line crossing the site. The fault is oriented NE-SW and is downthrown to the SE. Maximum offset at the top of the Knox is estimated to be 30 m (100 ft) east of the site and 46.1 m (150 ft) to the northeast. Due to the fact that the Curdsville fault dips to the southeast, its subsurface location is displaced in that direction at the Knox horizon. The maximum fault displacement of 150 ft. is less than the thickness of the Maquoketa Shale (430 ft), indicating there is continuity of the primary seal across the fault.



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A list of references can be found on 4.2b.1.

4.2a.2. Capillary Entry Pressure—Cambro-Ordovician Knox Supergroup (Primary).

Capillary entry pressure data was not available on the primary seal (Maquoketa Shale) for the Cambro-Ordovician Knox. Special cap rock analyses that provide similar data, however, are available from two wells that demonstrate overlying strata contain adequate seals. In the Texas Gas 1A Kerrick and Dupont wells threshold pressures were measured for core collected in the Black River and Wells Creek carbonates and shales above the Knox. These zones are an additional seal for the Knox reservoir at the Henderson County site and lie below the primary Maquoketa seal. Threshold pressure is defined by Katz and Coats (1968) as the pressure required to cause continuous motion of the gas-water interface through the caprock.

Texas Gas 1A Kerrick well (670 feet above Knox, 1,115 feet above reservoir)

Depth	Porosity	Permeability to water	Threshold Pressure
4954-4955	no data	0.00018	400
4964-4965	no data	0.000060	600

DuPont well (26 feet above Knox, 1,463 feet above reservoir)

Depth	Porosity	Permeability to water	Threshold Pressure
1686.4-1686.9	7.1	0.00028	150
1686.9-1687.6	8.2	0.00017	500
1687.6-1688.3	6.5	0.00057	150
1688.3-1689.0	6.3	0.000063	150

In known Knox reservoirs (injection wells, storage fields, and producing hydrocarbon fields), the surrounding dense carbonates of the Knox (permeabilities of <0.1 md in the Dupont well) provide adequate seals. At the proposed site, there should be 137 m (450 feet) of dense dolomite above the reservoir. Vertical hydraulic conductivities in the Knox-equivalent dolomites in the northern Midwest range from 8.6×10^{-7} to 1.1×10^{-3} feet/d (Young, 1992). In a regional model of this confining unit, Mandle and Kontis (1992) inferred a vertical hydraulic conductivity of 1.0×10^{-11} ft/s.

The Maquoketa Shale (373 m, 1,225 feet above the reservoir) is considered the ultimate confining unit for underlying Cambrian-Ordovician aquifers in much of the basin (see references in Young, 1992; McGarry, 1996; Eaton, 2001). The shale is estimated to be 131 m (430 feet) thick at the Henderson County site. In a regional model of the Maquoketa confining unit, Mandle and Kontis (1992) inferred a vertical hydraulic conductivity of 6.0×10^{-11} ft/s. The shale is also thought to be a source rock for some Trenton-Black River hydrocarbon production and so may also have carbon adsorptive properties similar to the New Albany Shale, which would improve its potential for sealing CO₂.

A list of references can be found on 4.2a.2.

4.2b.2. Capillary Entry Pressure—Devonian New Albany Shale.

The Devonian New Albany Shale is an unconventional reservoir where adsorption is the primary gas trapping mechanism. Capillary entry pressure does not apply as used in the sense of conventional reservoirs. CO₂ is expected to be trapped as a near-liquid density monolayer that coats the intragranular porosity associated with organic matter. The self-sealing nature of this trapping mechanism is controlled by reservoir temperature and pressure which in turn affect matrix diffusion rates. Common shale gas completions in both the Illinois and Appalachian basins employ fracture stimulations with proppants to enhance communication between the well bore and the natural fracture system.

4.2a.3. Fracture Gradient—Cambro-Ordovician Knox Supergroup (Primary).

The Dupont 1WAD well in Jefferson County, Kentucky had extensive injectivity testing in the Mt. Simon Formation. The open hole injection was from 5,408 feet to 6,008 feet and showed a fracture closure pressure of 1,200 psi surface pressure with fresh water in the hole. Injectivity surveys showed fluid entry from 5,540 feet to 5,620 feet. This information indicates a fracture closure pressure of 0.65 psi/ft. This fracture gradient of 0.65 psi/ft was also confirmed by another injection test after a liner had been set and the well was perforated from 5,422 feet to 5,785 feet. Injection surveys showed fluid entry from 5,480 feet to 5,750 feet. The fracture closure pressure of 1,200 psi was again recorded with fresh water in the well.

The shallower oil producing formations above 3,500 feet indicate fracture gradients from 0.7 psi/ft to above 1.0 psi/ft (Frailey et al., 2004); however, these gradients are indicators of likely horizontal fracturing.

References

- Eaton, Timothy T., 2001, Hydraulic conductivity and specific storage of the Maquoketa shale (Groundwater research report): Madison, Wisconsin, University of Wisconsin Water Resources Institute, [covers July 1998-December 2000], 39 p.
- Frailey, S.M., Grube, J.P., Seyler, B., and Finley, R.J., 2004, Investigation of liquid CO₂ sequestration and EOR in low temperature oil reservoirs in the Illinois Basin: Society of Petroleum Engineers paper 89342, 2004 SPE/DOE Fourteenth Symposium on Improved Oil Recovery, Tulsa, OK, 11 p.
- Katz, D. L. and Coats, K. H. : Underground storage of fluids, Ulrich.s books Inc., Ann Arbor, MI, 1968.
- Kolata, D.R., and Noger, M.C., 1990, Tippecanoe 1 sequence Middle and Upper Ordovician Series, in Leighton, M.W., Kolata, D.R., Oltz, D.F., and Eidel, J.J., eds., Interior Cratonic Basins: American Association of Petroleum Geologists Memoir 51, p. 89-99.
- Mandle, R. J., and Kontis, A. L., 1992, Simulation of regional ground-water flow in the Cambrian-Ordovician aquifer system in the northern Midwest, United States: U.S. Geological Survey, Professional Paper 1405-C, 97 p.
- McGarry, C.S., 1996, Geologic modeling for landfill screening: Integrating GIS with geospatial modeling, in Third International Conference/Workshop on Integrating GIS and Environmental Modeling, Santa Fe , New Mexico, CD-ROM, www.ncgia.ucsb.edu/conf/SANTA-FE-CD-ROM/sf_papers/mcgarry_christopher/santafe.html <http://www.ncgia.ucsb.edu/conf/SANTA-FE-CD-ROM/sf_papers/mcgarry_christopher/santafe.html>
- Noger, M.C., and Drahovzal, J.A., 2005, Structural cross section KY-1: Kentucky Geological Survey, Ser. 12, Report of Investigations 13, 1 plate.
- Young, H.L., 1992, Hydrogeology of the Cambrian-Ordovician aquifer system in the northern Midwest, United States: U.S. Geological Survey, Professional Paper 1405-B, 99 p.

4.2b.3. Fracture Gradient—Devonian New Albany Shale.

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The shallower oil producing formations above 3,500 feet indicate fracture gradients from 0.7 psi/ft to above 1.0 psi/ft (Frailey et al, 2004); however, these gradients are indicators of likely horizontal fracturing.

Reference

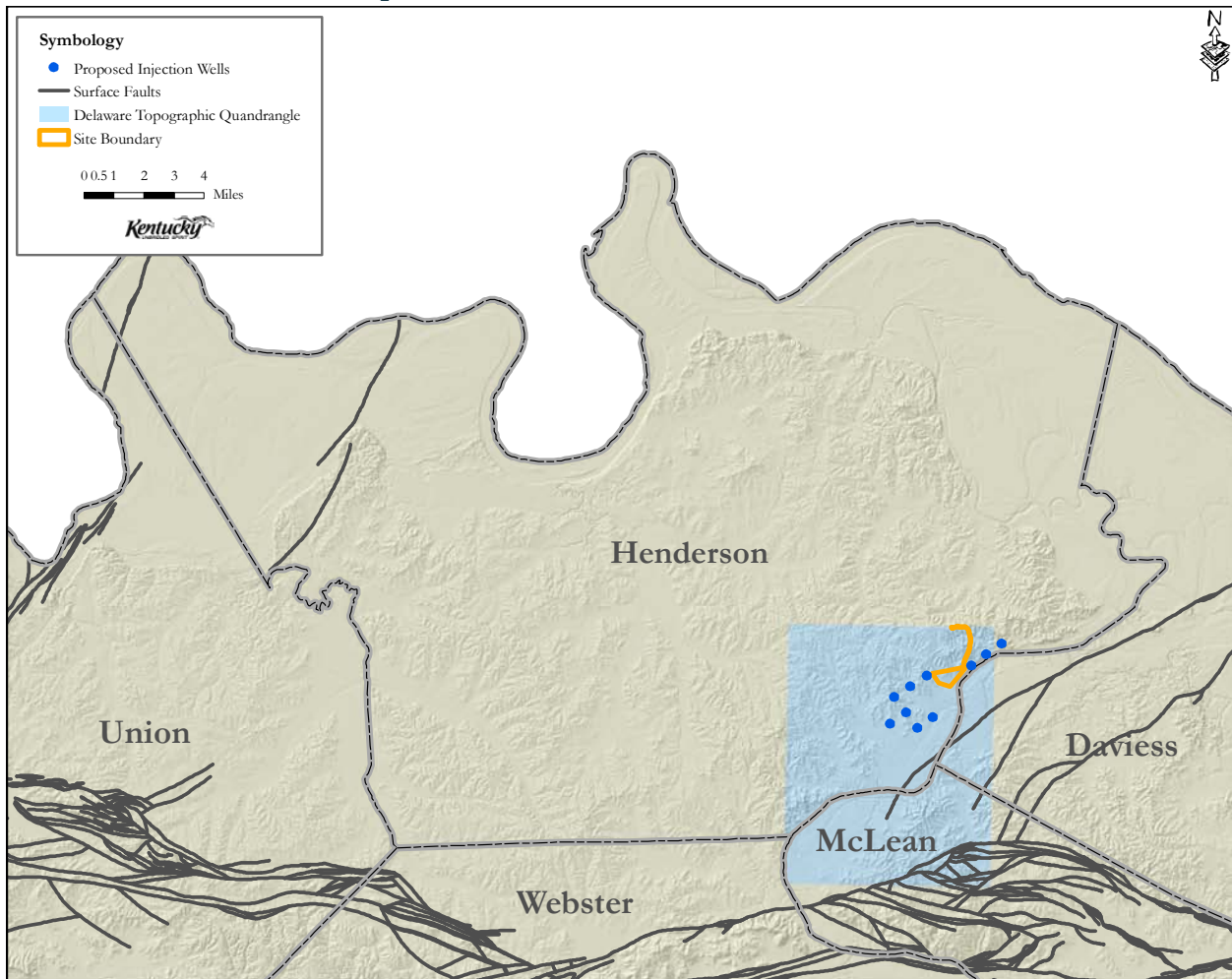
Frailey, S.M., Grube, J.P., Seyler, B., and Finley, R.J., 2004, Investigation of liquid CO₂ sequestration and EOR in low temperature oil reservoirs in the Illinois Basin: Society of Petroleum Engineers paper 89342, 2004 SPE/DOE Fourteenth Symposium on Improved Oil Recovery, Tulsa, OK, 11 p.

4.2a.4. Injection Well Penetrations— Cambro-Ordovician Knox Supergroup (Primary).

It is estimated that 10 vertical wells will be required to meet the injection rate target of 1 million metric tonnes per year for up to 30 years as calculated in section 2.5.3.

No existing injection wells penetrate the Cambro-Ordovician Knox Supergroup, the overlying Cambro-Ordovician carbonates (secondary seals), or the Maquoketa Shale (primary seal) in Henderson County. This precludes potential leaks through the identified seals via existing well bores. In Kentucky, Class II injection wells are currently tracked and regulated by the U.S. EPA Region IV, Atlanta, Georgia. The closest injection wells in the Knox are the IMCO Recycling well in Butler County, Ky. 83 km (52 miles), and the Dupont wells in Louisville, Kentucky, 148 km (92 miles) east of the site.

Proposed CO₂ Injection Wells (10 total) for FutureGen Plant

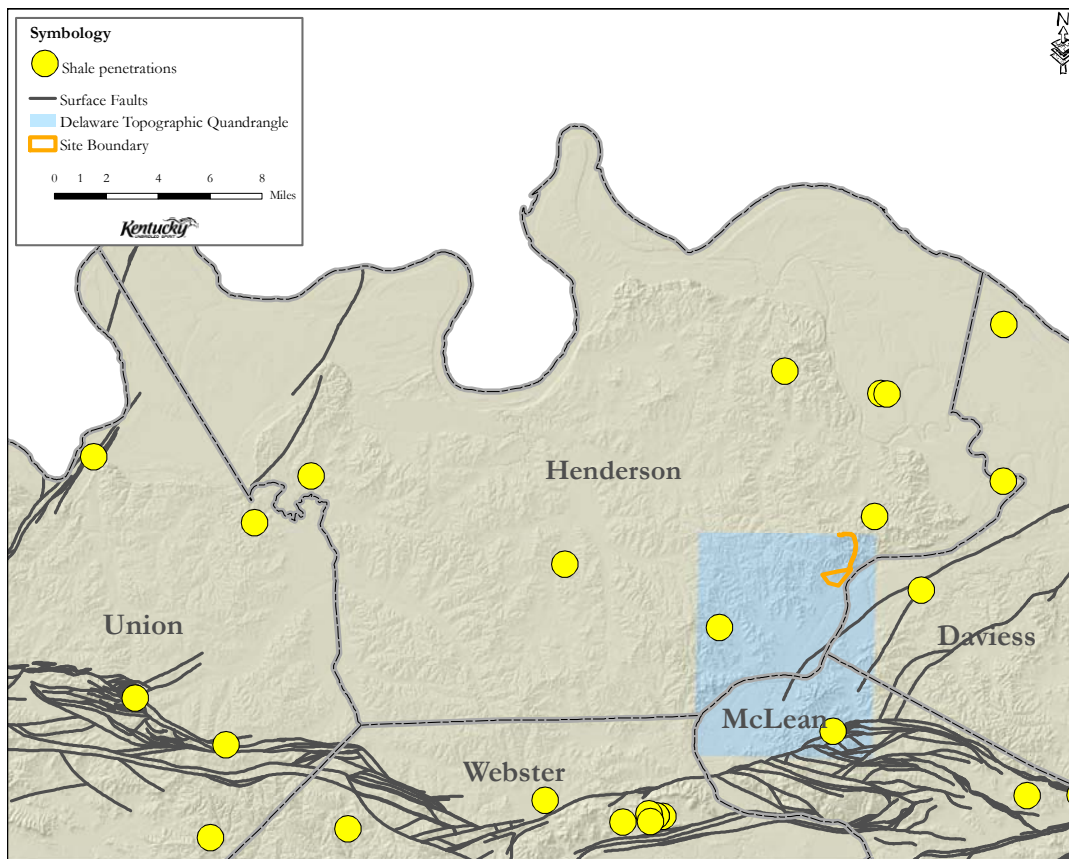


4.2b.4. Injection Well Penetrations—Devonian New Albany Shale.

Factors controlling the number of injection wells and consigning the New Albany to consideration as an alternate target are low permeability and relatively short project lifetime. To meet storage rate expectations stated in the RFP and given the current gas storage capacity and pressure data, it may require 50 or more conventional vertical injection wells. Organic matter content, fracture gradient, reservoir pressure, gas storage capacity, and other factors may be more favorable than anticipated and would reduce the number of wells required for this storage opportunity.

The New Albany Shale is an unconventional gas reservoir. Common completion practice employs fracture stimulation and proppants to enhance communication between the well bore and the natural fracture system. This stimulation will reduce the number of calculated injection wells. Another option to reduce the total number of injection wells would be to drill horizontal wells into the shale. This option has successfully been used to increase shale gas production in the Columbia 21747 Pocahontas well in Martin County, Eastern Kentucky (a DOE research well). Currently, horizontal wells are being permitted and drilled in the New Albany Shale east of the Henderson County site. Completion and production data are not yet available to evaluate any increase in production or gas reserves.

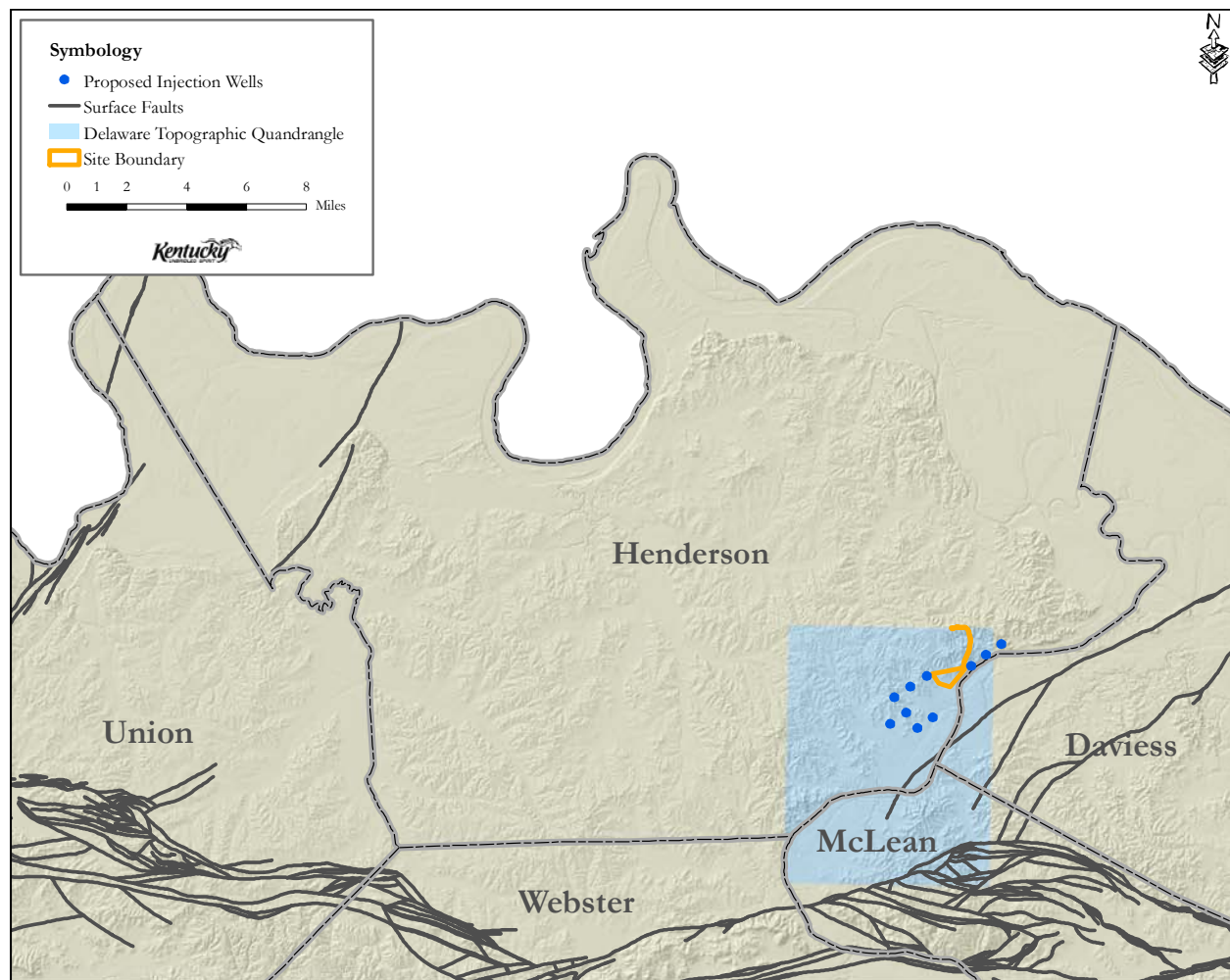
At this time, no injection wells penetrate the New Albany Shale in Henderson County. In Kentucky, Class II injection wells are currently tracked and regulated by the U.S. EPA Region IV, Atlanta, Georgia.



4.2a.5. Other Penetrations—Cambro-Ordovician Knox Supergroup (Primary).

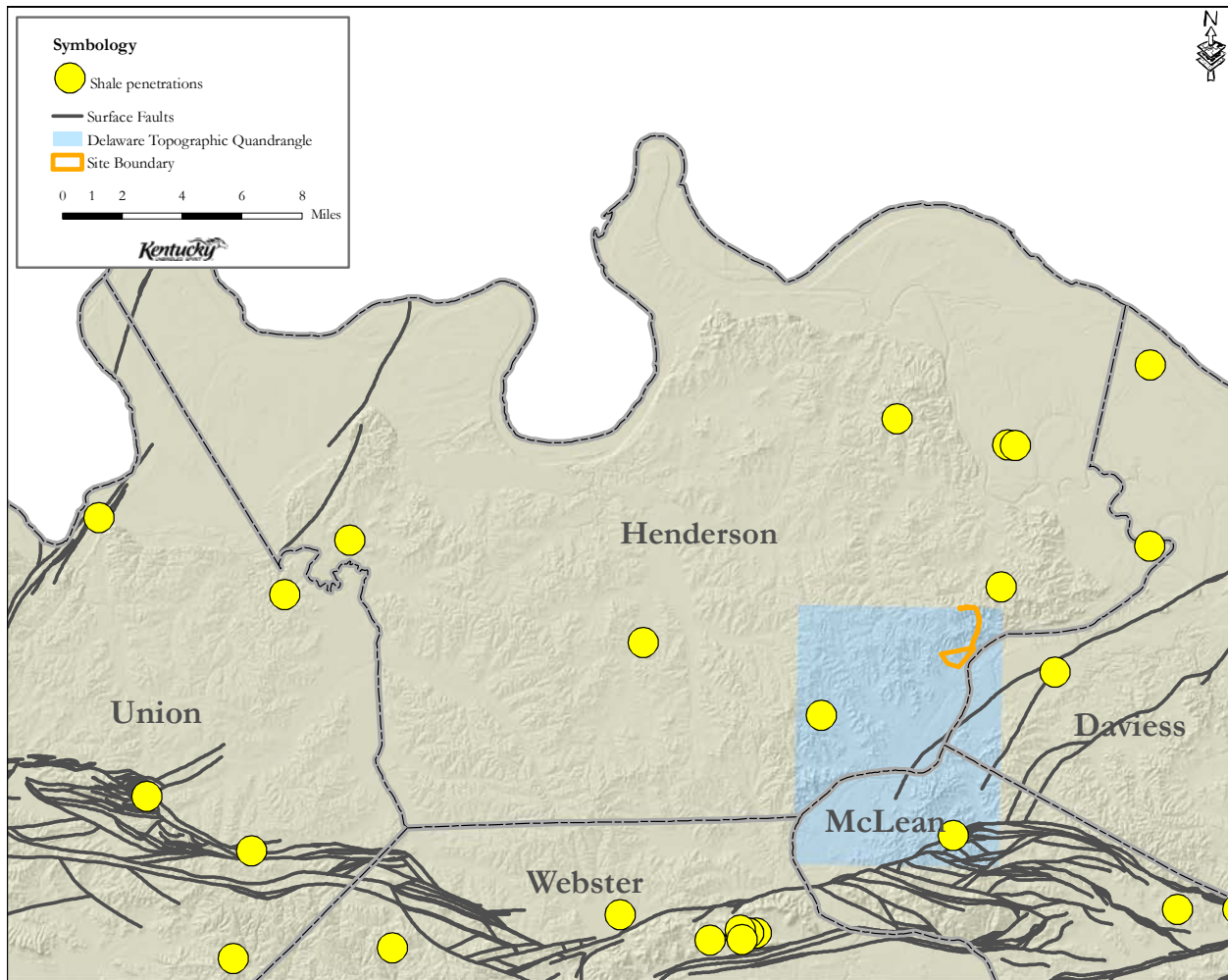
There are no wells in Henderson or neighboring Daviess counties that penetrate the Cambro-Ordovician Knox Supergroup or the primary seal, the Maquoketa Shale.

Existing shallower penetrations above the primary seal are not expected to compromise the Knox as a sequestration candidate. Five penetrations of the Knox occur in the Rough Creek Fault System, south of the site. The closest two penetrations, the Exxon Bell well in Webster County, and the Texas Gas 1A Kerrick well in McLean County are 16.1 km (10 miles) and 17.7 km (11 miles) away, respectively.



4.2b.5. Other Penetrations—Devonian New Albany Shale.

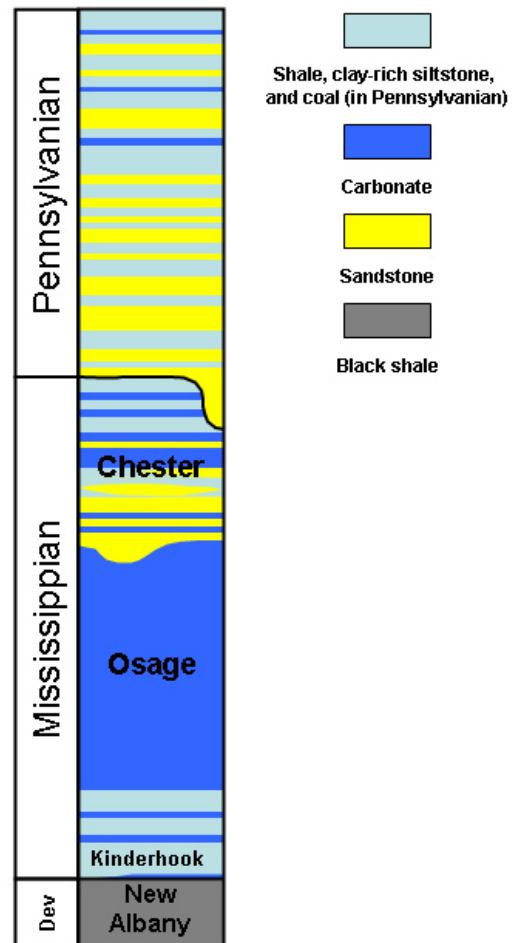
The New Albany shale is expected to store CO₂ in the adsorbed state and will essentially serve as its own seal. There are seven wells that penetrate the New Albany Shale in Henderson County. The top of the New Albany shale is below 1,067 meters (3,500 feet). The nearest well to the site that penetrates the New Albany Shale is the Har-Ken H1 King-Pruitt with a drilling depth to the shale of 1,122 meters (3,680 feet). The existing shallower penetrations are not expected to compromise the shale as a sequestration candidate.



4.2a.6. Secondary Seals—Ordovician Knox.

The primary seal is the Upper Cambro-Ordovician Maquoketa Shale (213 m, 700 ft above the reservoir). The Maquoketa Shale is estimated to be 430 ft thick at the Henderson County site and has been identified as the primary confining unit of Midwest Cambro-Ordovician aquifers in numerous studies (references in Young, 1992) including the phase 1 findings of the MGSC and MRCSP carbon sequestration partnerships (in review).

Secondary seals above the Maquoketa Shale include the Devonian New Albany Shale, the Mississippian New Providence Shale Formation (Kinderhook), Mississippian Borden and Fort Payne Formations (Osage), and multiple Pennsylvanian shales. The New Albany Shale occurs 701 m, (2,300 ft) above the reservoir, and is approximately 80 meters (262 ft) thick. As an organic shale it combines the low permeability attributes of a clay matrix with carbon adsorption. Reported permeabilities in the New Albany are <0.1 to .0005 md in Eastern Kentucky (Nuttall and others, in press) and presumably are similar in Western Kentucky. The New Providence Formation (Kinderhook) and Borden and Fort Payne Formations (Osage) are predominately shale with lesser dark siliceous limestone. The combined thickness of this interval in Henderson County is approximately 500 feet. The Pennsylvanian Tradewater Formation contain shales 50 to over 200 feet thick interbedded with fluvial sandstones. The thicker shales in this interval are laterally continuous over Western Kentucky including the CO₂ plume area.



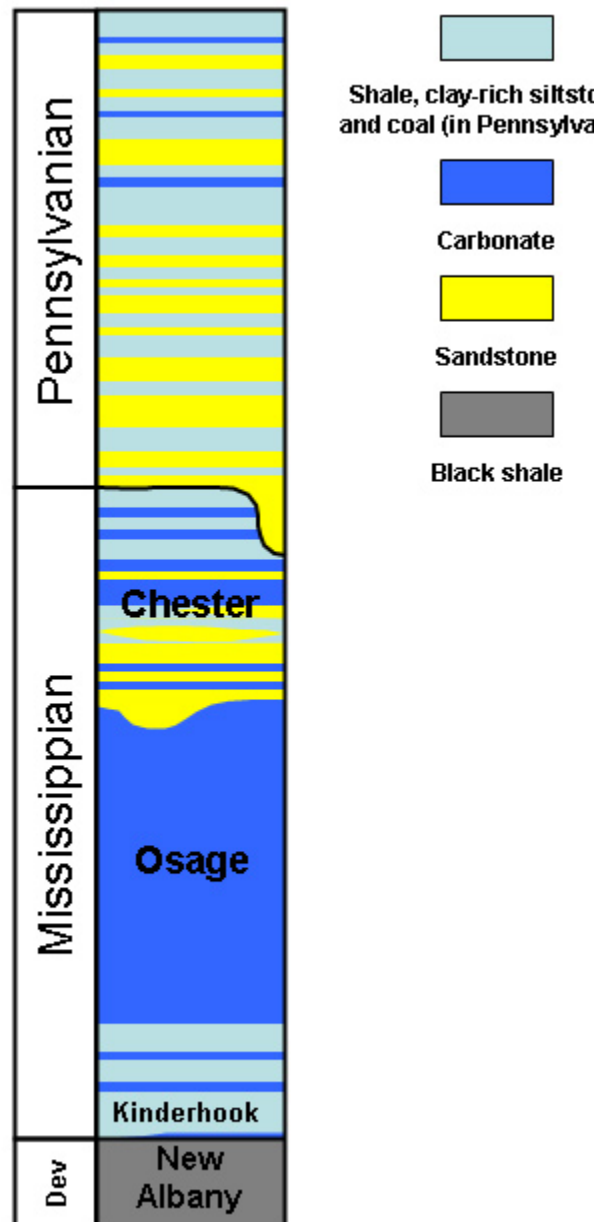
References

- Nuttall, B.C., Eble, C.F., Drahovzal, J.A., and Bustin, R.M., in press, Analysis of Devonian Black Shales in Kentucky for Potential Carbon Dioxide Sequestration and Enhanced Natural Gas Production: Kentucky Geological Survey, URL www.uky.edu/KGS/emsweb/devsh/devshseq.html, visited 22-Feb-2006.
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4.2b.6. Secondary Seals—Devonian New Albany Shale.

The Devonian New Albany Shale is an unconventional reservoir where adsorption is the primary gas trapping mechanism. Capillary entry pressure does not apply as used in the sense of conventional reservoirs. CO₂ is expected to be trapped as a near-liquid density monolayer that coats the intragranular porosity associated with organic matter. The self-sealing nature of this trapping mechanism is controlled by reservoir temperature and pressure which in turn affect matrix diffusion rates.

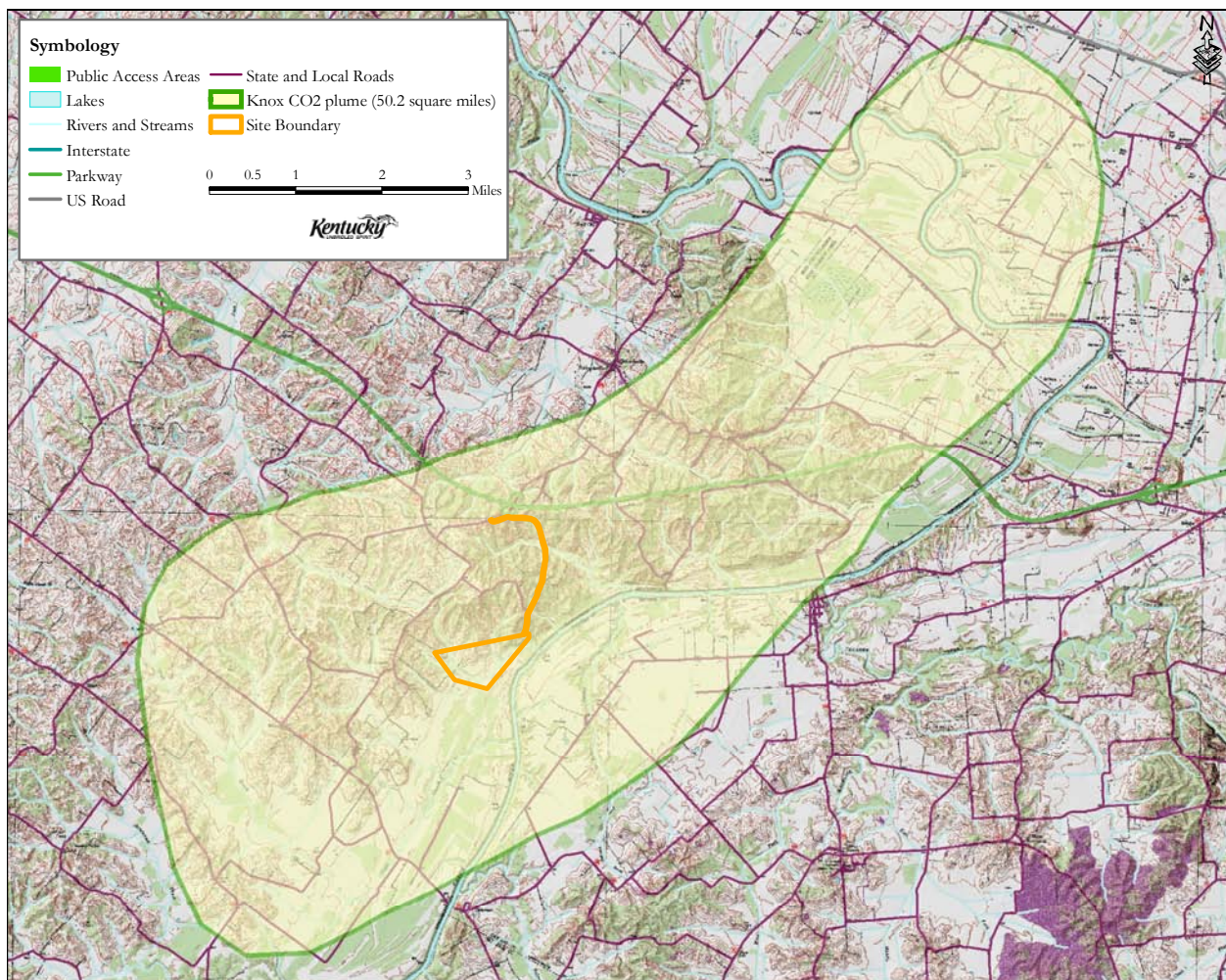
Low permeability Pennsylvanian shales, coals, and carbonates and Mississippian shales and carbonates that overlie the New Albany Shale are expected to provide secondary sealing capacity for the New Albany Shale. The base of the Mississippian (Kinderhook) is dominated by the New Providence shale. The middle part of the Mississippian (Osage), is dominated by well-cemented carbonates and shaley carbonates (Fort Payne and Borden equivalents); reservoirs in this sequence are typically oolite shoals with locally important porosity. These units immediately overlie the New Albany shale, are regionally extensive, and would serve as a secondary seal for the New Albany. The combined thickness of the Kinderhook and Osage units in this area is 550 feet. In the upper part of the Mississippian (Chester), carbonates and sands form oil and gas reservoirs that are locally sealed by shales. Overlying these Mississippian units, the Pennsylvanian rocks of Henderson County are as much as 50 percent low-permeability shales, clay-rich siltstones, and coals.



4.3. Monitoring, Mitigation, and Verification

4.3.1. Physical Access.

More than 60% of the plume area is physically accessible for installation of monitoring equipment. The majority of the plume area has been identified as being controlled by Penn Virginia which has signed an MOU with the Commonwealth of Kentucky which is included in 3.2.1 Appendix. Five hundred and eighty-five private, one federal, one state and one local government landowner, including 375 residences were identified above the 50(+) square mile plume area according to the Kentucky Department of Revenue. Other access restrictions include the Green River, Audubon Parkway and state and local roads. There are no major towns within the proposed plume area. This area is predominantly agricultural, unmanaged forest, and mining operations. The plume area is sparsely populated and generally owned in large tracts or controlled by mining leases. A limited area associated with the adjacent mine facilities will impact access.



4.3.2. Legal Access.

The Commonwealth has recently executed an MOU with Penn Virginia Operating Company, LLC, who owns the majority of the mineral rights in the plume area (included in 4.3.2 Appendix). This MOU is a commitment of the parties to negotiate access to the target formations. Penn Virginia owns approximately 16,000 of the 18,000 acres of surface or mineral rights the Kentucky Department of Revenue has identified within the projected plume area. See Appendix 4.3.2 for documentation.

4.3.3. Monitoring, Mitigation, and Verification: Subsurface Access

There are no unusual drilling or well completion problems in the area that would affect the installation of monitoring wells.

Formations lying above the Maquoketa Shale primary seal consist of a thick sequence (1,875 meters or 6,150 feet) of Silurian, Devonian, Mississippian, and Pennsylvanian age limestones, shales, sandstones, and dolostones. Henderson and Daviess Counties contain numerous oil fields producing from Mississippian and Pennsylvanian carbonates and sandstone reservoirs. In addition, underground coal mines occur near the proposed site.

Producing oil fields and active coal mines in the area will not preclude the drilling of CO₂ monitoring wells, but they should be considered during planning of the monitoring well program. Oil reservoir zones and open mines would obviously not be suitable horizons for monitoring activities. Numerous other intervals are available for monitoring.

PART 5--Best Value Assessment Criteria

Summary.

Introduction

Kentucky is a magnificent place of natural beauty, inviting communities and industrious people. The unbridled spirit of our Commonwealth is renowned. Kentucky has much to offer. From the Eastern and Western Coal Fields, to the Lake Lands, to the lush hills of the Bluegrass Region, there are countless reasons to visit, live and work in the Commonwealth. Our natural resources and friendly citizens provide a quality of life that is matchless. Kentuckians take pride in their rolling landscapes, historic small towns, visual and performing arts, history and cultural heritage, lakes, caves, world-class dining and shopping, horse and auto racing and college athletics.

Kentucky is a state that is open for business. In 2005, *Site Selection* magazine ranked Kentucky 9th in the nation in its Annual Business Climate Rankings. According to the editor of *Site Selection*, "Kentucky is demonstrating solid improvement in its business climate, and corporate site selectors are rewarding that effort."

Kentucky is the nation's third largest coal producing state producing 119 million short tons in 2005 and containing 1.1 billion tons of recoverable coal reserves at active mine sites. Kentucky has two distinct coal fields, each containing numerous deposits of bituminous coal of various characteristics and mines of every type and size. Kentucky's coal industry employs over 15,000 people at an average wage of \$47,000 per year. According to a study the University of Kentucky's Center for Business and Economic Research, "the \$3.15 billion in receipts from coal produced and processed in Kentucky generated additional economic activity totaling \$3.69 billion and another 41,000 jobs. This additional economic activity, plus coal production and processing, yielded a total economic activity in Kentucky of \$6.84 billion and 56,000 jobs."

Over ninety percent of Kentucky's electricity is generated from coal. This fact has proven to be significant for the Commonwealth in that Kentucky enjoys some of the lowest rates of electricity in the nation. The viability of coal as a clean energy resource is vital to Kentucky and to the nation to preserve low-cost electricity. Historically, coal has proven to be the least costly fuel for electricity generation. The U.S. Department of Energy projects that this will remain the case for the next 20 years:

	2002	2010	2015	2020	2025
Petroleum	\$4.32	\$4.21	\$4.54	\$4.67	\$4.88
Natural Gas	\$3.77	\$4.04	\$4.78	\$4.85	\$4.92
Steam Coal	\$1.26	\$1.22	\$1.22	\$1.20	\$1.22

***Electric Power Prices by year and energy source. (2002 Dollars per million BTU)
Source: U.S. Department of Energy, Energy Information Administration.***

Kentucky is also a leader in the deployment of advanced clean coal technology. When releasing Kentucky's comprehensive energy strategy, Governor Fletcher stated, "Kentucky is open for the clean coal business." Since 2004, over \$2.1 billion in base

load, clean coal generation has been announced in the Commonwealth. The Commonwealth of Kentucky is also competing for the first regulated baseload integrated gasification combined cycle power plant, demonstrating its commitment to the deployment of this next phase of clean coal technology by considering progressive legislation to ensure regulatory certainty to base load investors.

There is universal support as shown in letters found in the Supporting Documents from the various levels of political leadership for the FutureGen project to be sited in Kentucky:

- **Governor Ernie Fletcher:** "Kentucky's proposal offers a tremendous set of attributes that would provide the Alliance with an excellent location to construct the FutureGen project."
- **U.S. Senator Mitch McConnell:** "I hope that you will realize the importance of this initiative to Kentucky and to the nation and give appropriate consideration to this application."
- **U.S. Senator Jim Bunning:** "I support Kentucky's proposal and believe it will allow the FutureGen project to move forward with the full backing of the people, government and industry of Kentucky."
- **Congressman Ed Whitfield:** "I am aware that several states will submit proposed FutureGen sites. I am confident that none will offer a better combination of site characteristics, abundant coal reserves, research capabilities, experience in clean coal technology and support of its state government leaders and Congressional delegation."
- **State Senator Dorsey Ridley:** "I can think of no better place to promote (investment in clean coal technology) through the construction of the FutureGen facility than Henderson County, Kentucky."
- **State Representative Gross Lindsay:** "I applaud the FutureGen project for what it can mean to Henderson County, the Commonwealth of Kentucky and the United States and offer my support and assistance in any way appropriate..."
- **Henderson County Judge Executive Sandy Watkins:** "I wish to express my very strong support for the siting of the FutureGen project in my county."
- During the 2006 legislative session, both bodies of the Kentucky General Assembly adopted resolutions supporting the efforts "to have Kentucky selected as the site of the FutureGen project."
- According to **state Representative Tanya Pullin, co-chair of Kentucky's special subcommittee on Energy**, "I actually think everybody recognizes the importance of (the FutureGen) project to Kentucky and to the nation's future energy strategy and to our security."
- **State Senator Robert Stivers, co-chair of Kentucky's special subcommittee on Energy** stated, "Landing FutureGen would put Kentucky at the forefront in the development of alternative energy."

Given the state's business climate, its heritage and history as a coal producing state, its commitment to coal fueled generation as a low cost energy provider, its status as a leader in the deployment of clean coal technology and the overwhelming political support for the project, Kentucky is well positioned to be the home of FutureGen.

Kentucky's Financial Commitment to FutureGen

The Kentucky Office of Energy Policy is currently managing the Commonwealth of Kentucky's efforts to attract the FutureGen project. The recently enacted state budget allocated \$7 million to the Kentucky Office of Energy Policy over the next biennium for energy research and development "which shall be used for research projects relating to clean coal, new combustion technology...and the development of alternative transportation fuels produced by processes that convert coal." The FutureGen project clearly meets these criteria.

Therefore it is the intention of the Commonwealth of Kentucky to utilize a portion of these resources to advance the FutureGen project's objectives and put forth the following financial commitments:

- Per the requirement of Section 1.5.7, the Kentucky Office of Energy Policy will provide up to \$200,000 to prepare an Environmental Information Volume should Kentucky's site be selected as a Candidate Site.
- The Kentucky Office of Energy Policy will provide up to \$1 million for further site characterization should Kentucky's site be selected as a Candidate Site.
- The Kentucky Office of Energy Policy will purchase the proposed site acreage and sell the site to the FutureGen Industrial Alliance for \$1 should Kentucky's site be selected as the Preferred Site.
- The Kentucky Office of Energy Policy will provide up to \$500,000 to construct a barge loading/unloading facility should Kentucky's site be selected as the Preferred Site.
- The Kentucky Office of Energy Policy will provide up to \$200,000 for the application fee for the Industrial Alliance to comply with Kentucky's regulatory framework for siting electric transmission facilities at the point that such a requirement becomes necessary.

Additionally, during the 2006 session of the Kentucky General Assembly, House Bill 422 contained the following provision:

(the) taxes imposed by this chapter (KRS 139 – Kentucky's Sales and Use Tax Provisions) shall not apply to the sale, rental, storage, use or other consumption of tangible personal property used to construct, repair, renovate, or upgrade a coal-based near zero emission power plant including repair and replacement parts purchased for the plant.

Although HB 422 – an omnibus tax bill – did not receive final approval by the end of the legislative session, the provisions of the proposed bill encountered no controversy. If Kentucky's site is selected as a Candidate Site, the Commonwealth of Kentucky is prepared to consider the proposed provisions for a "coal-based near zero emission power plant" in the 2007 session of the General Assembly.

Cost

The Commonwealth of Kentucky is prepared to purchase the proposed site acreage and sell the site to the FutureGen Industrial Alliance for \$1 should Kentucky's site be selected as the Preferred Site.

Availability and Quality of Existing Plant and Target Formation Characterization Data

Kentucky's FutureGen site has been well characterized in past years. While there has not been a formal environmental assessment, the entire site has undergone surface coal mining and reclamation. The surface is reclaimed with portions still under reclamation surety bonds as required by the Commonwealth to insure final success of revegetation.

Location of this site as a commercial/industrial facility would immediately qualify the area for a full bond release after a post-mining land use is approved by Kentucky DNR's Division of Mine Permits.

Terrain was altered and elevations actually increased for much of the site, thus raising much of the site 146 acres above the 500 year flood plain delineation from the existing FEMA map. Additionally a levee was constructed along the Green River to prevent flooding of the surface mined areas. The levee elevations currently run from approximately 385 feet to 387 feet in the vicinity of Kentucky's FutureGen site. Raising the levee to the 386 feet elevation, the 100-year flood stage would effectively take the entire Kentucky FutureGen site out of the projected flood-plain. Raising the levee to 390' would take the site out of the 500-year flood plain.

As stated before, the Commonwealth of Kentucky is prepared to invest \$1 million in additional site characterization.

Land Ownership

The approximately 215-acre Kentucky FutureGen site is currently controlled by Cash Creek.

An option agreement has been executed between Cash Creek and the Kentucky Commerce Cabinet that will allow for the Commonwealth of Kentucky to purchase the FutureGen site from Cash Creek if Kentucky is selected as the Preferred Site for the FutureGen project.

As stated earlier, the Commonwealth of Kentucky is prepared to sell the approximately 215 acre tract to the FutureGen Alliance for \$1.

Mineral rights in the vicinity are owned by Penn Virginia, which has 56,000 acres of mineral properties, including 16,000 acres of surface ownership. Penn Virginia has been identified by the Kentucky Department of Revenue as the majority owner within the plume area.

Penn Virginia and the Commonwealth of Kentucky have executed a Memorandum of Understanding to negotiate for the use of subsurface mineral rights and to negotiate for additional areas, as needed. These documents can be found in the Part 5 Appendix.

Residences or Sensitive Receptors above Target Formation

- There are no hospitals, schools or nursing homes above the target formation.
- Landowner information: 585 private; one federal; one state; and one local government landowner above the 50(+) square mile target formation, including approximately 375 residences.

Source: KY Department of Revenue, Office of Property Valuation

Waste Recycling and Disposal

Solid waste may be beneficially reused under the Permit by Rule provisions of 401 KAR 47:150, which requires no application or review, provided that Kentucky's Environmental Performance Standards are met as defined by 401 KAR 47:030.

If Kentucky's Environmental Performance Standards as defined by 401 KAR 47:030 are met, utility wastes (fly ash, bottom ash, scrubber sludge) may also be beneficially reused under the Permit by Rule provisions of 401 KAR 45:060, which requires no application or review.

Special waste landfill permits are issued within 180 days of receipt of an administratively complete application. Special waste includes mining and utility wastes.

The Resource Conservation and Local Assistance Branch within the Department for Environmental Protection provides assistance with finding markets for and publicizing the availability of products for beneficial reuse. All regulatory and statutory documentation in Part 5.

Clean Air Act Compliance

Given the target for FutureGen to be a near zero emission plant during normal operations, it is not anticipated that there will be any issues with Clean Air Act compliance. This assumption is validated by the increment consumption analysis that was completed by the Department for Environmental Protection for a proposed facility with similar gasification technologies in the area.

Per regulation 401 KAR 51:017, increments available at the Kentucky site a:

Class I:

PM10: 4 µg/m³ (annual); 8 µg/m³ (24 hour)

NO_x: 2.5 µg/cubic meter (annual)

SO₂: 2 µg/m³ (annual); 5 µg/m³ (24 hour); 25 µg/m³ (3 hour)

Class II:

PM10: 17 µg/m³ (annual)

NO_x: 25 µg/m³ (annual)

SO₂: 20 µg/m³ (annual); 91 µg/m³ (24 hour); 512 µg/m³ (3 hour)

There are existing monitors located near the Kentucky FutureGen site that adequately address the preconstruction monitoring requirements. Therefore no additional pre-construction monitoring will be required when the Kentucky site is chosen.

Expedited Permitting

This table contains all of the necessary state permits that would be required to site the FutureGen facility in Kentucky, the permitting agency responsible for issuing the respective permits, the timetable required for the issuance of the respective permits and the applicable statute or administrative regulation governing their issuance.

Permit	Permitting Agency	Timetable required by Statute or Administrative Regulation	Applicable Statute or Administrative Regulation
Water Withdrawal Permit	Environmental and Public Protection Cabinet/ Division of Water	90 days	401 KAR 4:300
Title V Air Permit	Environmental and Public Protection Cabinet/Division for Air Quality	18 months	401 KAR 52:020
Special Waste Permit	Environmental and Public Protection Cabinet/ Division of Waste Management	180 days	401 KAR 45:025
Transmission Line Siting Certificate	Kentucky Electric Generation and Transmission Siting Board	120 days	KRS 278.714(3)
Kentucky Pollution Discharge Elimination System Permit	Environmental and Public Protection Cabinet/ Division of Water	180 days	401 KAR 5:300

The Commonwealth of Kentucky will appoint a “permitting liaison” for the FutureGen project to ensure the state permitting process is coordinated and expedited to the greatest extent possible.

The federal permits required for siting the FutureGen project within Kentucky are:

- Deep Well Underground Injection Control Program administered by the U.S. Environmental Protection Agency – Region IV.
- Threatened or Endangered Species and Critical Habitat issued by the U.S. Fish and Wildlife Service.
- Objects Affecting Navigable Airspace issued by the Federal Aviation Administration.

Kentucky’s proposed site is zoned for heavy industrial use – therefore no significant additional regulatory permits should be required at the local level.

According to the FutureGen RFP, “permitting requirements are key risks to the project schedule and costs.” The Commonwealth of Kentucky agrees with this conclusion and has taken significant steps to streamline and ensure regulatory certainty within the permitting requirements for the FutureGen project.

- House Bill 470 – Given some recent complications presented to entities interested in constructing generation within Kentucky, the Fletcher administration proposed and the Kentucky General Assembly passed legislation to ensure that any administrative appeal of certain permits pertaining to generation construction will take no longer than 360 days for

- a decision to be rendered. Further, once a decision from the administrative process has been rendered, the Secretary of the Environmental and Public Protection Cabinet shall grant a final decision on any case within a maximum of 135 days.
- House Bill 665 – Exempts any “facility designed to achieve minimum emissions, built for demonstrating the feasibility of producing electricity and hydrogen from coal, whose site has been determined acceptable from an environmental impact perspective in a record of decision published by the United States Department of Energy after January 1, 2006 and has received all local planning and zoning approvals” from the Kentucky State Board on Electric Generation and Transmission Siting.

Transmission Interconnection

Kentucky’s FutureGen site can interconnect with E.ON U.S. and/or Big Rivers Rural Electric Corporation (BREC). The interconnection process with E.ON U.S. is performed by the Midwest ISO (MISO). No attempts have yet been made for interconnection of the FutureGen facility to the Electric transmission grid.

The interconnection process for BREC, which is similar to that of the MISO, takes approximately 8 months to get to the facilities design and construction phase (for MISO the process takes between 19 and 22 months). The process begins with an application which includes the capacity and general location of the facility, interconnection voltage and configuration. At the applicant’s expense, the Transmission Provider will conduct a feasibility study indicating the required system network modifications and a cost estimate for those modifications. If the applicant notifies the Transmission Provider that it wishes to proceed, then an interconnection study is conducted, followed by the facilities study which will scope the actual interconnection project and provide a definitive cost estimate and estimated construction schedule. The customer then may enter into an agreement with the Transmission Provider to perform detailed engineering design, material procurement, and construction. At this time, the applicant may also develop a Transmission Service Agreement with Transmission Provider.

Background CO₂ Data

There is no current data on the background levels of CO₂ for the proposed site. Significant expertise exists within the Commonwealth of Kentucky, through the Kentucky Geological Survey, to establish this data. KGS has received funding from the U.S. Department of Energy to measure background CO₂ and to develop better methods for monitoring mitigation and verification microseepage.

As proposed earlier, the Kentucky Office of Energy Policy is prepared to put forth up to \$1 million for additional site characterization if the Henderson County site is selected to make the Candidate List. These funds could be utilized to collect the background CO₂ data required by the FutureGen Alliance.

Power Sales

A commitment by any creditworthy organization to purchase the power output of the FutureGen facility has not been reached.

A recent study by the Kentucky Public Service Commission reported that the state of Kentucky will require an additional 7,000 megawatts of additional generating capacity by 2025 – which presents an opportunity for the FutureGen Alliance to identify purchasers for the electrical output of the plant.

In terms of reaching a broader national power market, the proposed transmission interconnection reaches both Midwest and Northeast energy markets.

Market for H₂

The market for H₂ consists primarily of:

- Fertilizer manufacturers
- Petroleum refineries

There are no large scale fertilizer manufactures or petroleum refineries within 100 miles of the Kentucky FutureGen site.

The nearest large scale petroleum refinery (@ 190,000 barrels per day) is located in Memphis, Tennessee – approximately 250 miles away.

CO₂ Title and Indemnification

Several provisions of the Constitution of the Commonwealth of Kentucky prohibit the Commonwealth from entering into contracts which would require the Commonwealth to expend public funds for indemnification purposes. As explained in an opinion by the Commonwealth's Office of the Attorney General:

Section 50 of the Kentucky Constitution prohibits any "agency of the state, including its legislature" from placing "an obligation against the general funds otherwise available for appropriation and expenditure by a future legislature." McGuffey v. Hall, Ky., 557 S.W.2d 401, 409 (1977). Section 177 of the Kentucky Constitution prohibits lending the credit of the Commonwealth to any person or corporation for any purpose - public or otherwise. See, McGuffey v. Hall, supra at 410. Additionally, payment of private claims would violate Kentucky Constitution Section 171, which requires that public funds be used only for public purposes. McGuffey v. Hall, supra.

Ky. Op. Atty. Gen. 86-18 (1986).

Accordingly, short of an amendment to Kentucky's Constitution, the Commonwealth is prohibited from taking title to the CO₂ and/or indemnifying the Industrial Alliance for any potential liability associated with the CO₂ and/or the sequestration thereof.

Other Considerations

1) MultiState Collaboration:

The Commonwealth of Kentucky, the Commonwealth of Pennsylvania and the State of Ohio have entered into a Memorandum of Understanding (MOU) (included in

Part 5 Appendix) to memorialize a collaborative relationship amongst its member states. The MOU permits any member state the option of submitting a response to the FutureGen site solicitation. It then states:

Should a Member State's proposal not be selected by the FutureGen Industrial Alliance to advance through the several stages of the site evaluation process, as defined in the Alliance's Final Request for Proposals, that Member State agrees to support proposal(s) from other Member States that survive the screening process and are included in the "Candidate Site List" to be submitted by the Alliance to the U.S. Department of Energy.

Given that the FutureGen Alliance is likely to consider a range of possible sites, it is recognized that multiple sites from the member states could make it to the "Candidate Site List." Therefore, the competition for selection for the Preferred Site would continue.

Ultimately, though, the members of this MOU agree that a site within a member state is preferable and will be supported by the MOU's signatories.

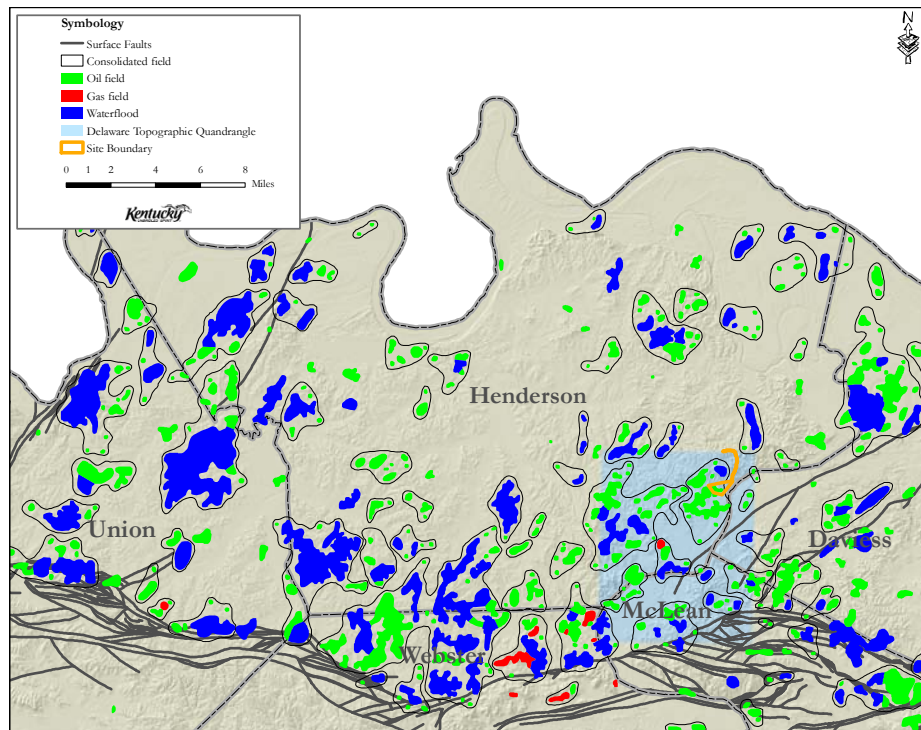
Further, the signatories of this MOU have organized the Ohio River Valley Coal Research Consortium. The signatories believe that there is significant research capacity within the universities of the member states that could be a tremendous asset to the FutureGen Alliance. The MOU can be found in Part 5 Appendix.

Membership of this Consortium includes the University of Kentucky, Penn State, University of Pittsburgh, Ohio State, Ohio University, University of Cincinnati, University of Akron, Case Western Reserve, University of Dayton and Carnegie Mellon.

Other member institutions may also be solicited to join.

2) Enhanced Oil Recovery:

According to "Basin Oriented Strategies for CO₂ Enhanced Oil Recovery: Illinois and Michigan Basins" (USDOE, February 2006), up to about 40 million barrels of crude oil may be economically recoverable using "enhanced oil recovery" (EOR) techniques from 8 depleted oil reservoirs in Kentucky located within about 25 miles of the proposed FutureGen site using state of the art "Immiscible CO₂ EOR" techniques. This figure is based on a crude oil price of \$30 per barrel. For \$40



per barrel oil, the recoverable amount is estimated to range from 60 million to 80 million barrels (a total value of \$2.4 billion to \$3.2 billion).

In addition, much larger oil fields that are amenable to EOR are located within 70 to 110 miles of the site in southeastern Illinois. The total quantity of oil that could potentially be recoverable using CO₂ from these fields is estimated to be as high as 450 million barrels, with a market value of \$18 billion (at \$40 per barrel). It is reasonable to assume that one or more oil producers would find it attractive to invest in pipelines to transport the CO₂ from the Kentucky site to utilize CO₂ for oil recovery. The CO₂ can be effectively sequestered in the oil fields, assuming that the non-producing wells are properly sealed, and appropriate procedures and safeguards for measurement, monitoring and verification of the CO₂ are taken. Total demand for CO₂ from these oil fields is estimated to be about 110 million tonnes, which would be about twice as much as the proposed FutureGen plant would generate over a 50 year operating period.

3) Synergistic Opportunities:

The Kentucky FutureGen site is adjacent to a site where a mine-mouth Integrated Gasification Combined Cycle (IGCC) project with a maximum continuous rating of 630 MW (net) and a co-production facility is proposed to be constructed. In a letter which is included in Part 5 Appendix from the developers from the proposed IGCC facility, it was stated that "if the project goes forward as planned and the Commonwealth is successful in its efforts to bringing FutureGen to Kentucky that the two projects will be positioned to extract certain synergies by being located in proximity to one another."

The letter continues:

"In support of those efforts, ... if (Kentucky) is selected as the site for the FutureGen Project, (the developer) will enter into negotiations to potentially share costs relating to infrastructure, supply lines and any other areas in which efficiencies or economies of scale can be achieved between FutureGen and (the proposed) IGCC project in a manner which is mutually advantageous to all parties concerned."

Items for which costs may be shared include, but are not limited to:

- Water Supply;
- Electric Substation and Transmission;
- Natural Gas Supply;
- Fuel Supply (conveyor and barge);
- Slag Disposal;
- Operations & Maintenance;
- Steam, Oxygen and Syngas Supply to Enhance Reliability (interconnection between gasification plants);
- Water Treatment;
- Stormwater Run-off and Wastewater discharge;
- Auxiliary Equipment (aux. boiler, fire pumps, etc.);
- Overall site maintenance (groundskeeping, security, etc.);

Consequently, significant cost savings to the FutureGen Alliance may be realized through a mutually beneficial arrangement.

4) A Trained Kentucky FutureGen Workforce:

Kentucky's workforce productivity is nearly 2% higher than the national average. Much of this is due to the Commonwealth's commitment to investments in its workers. Expansion magazine ranks Kentucky's workforce training programs as the third best in the nation.

Kentucky has several training programs that could potentially benefit the FutureGen project.

- **Bluegrass State Skills Program:** The Bluegrass State Skills Corporation's (BSSC) purpose is to improve and promote employment opportunities for the residents of the Commonwealth through training grants and investment credits for skills training programs which create partnerships with business and industry.
In FY 2004 – 2005, 100 skill training grants valued at over \$3.1 million were awarded. Of those:
 - » 2,600 Kentucky residents were being trained for new industry.
 - » 5,500 Kentucky residents were being trained for expanding industry.
 - » 7,700 Kentucky residents were being trained for existing industry.
- **Kentucky Coal Academy:** The Commonwealth of Kentucky has made a significant investment in its coal workforce through its community and technical college system. Currently over 2,000 students are enrolled in the Kentucky Coal Academy at five community college campuses around the state. Classes for the Academy are scheduled to be offered at the Henderson County Community College campus and are currently offered at the Madisonville Community College Campus – approximately forty miles away from Henderson. Kentucky's investment in the Kentucky Coal Academy was a significant contributing factor to a \$3 million grant being awarded from the Department of Labor to invest in the state's coal workforce.
Although FutureGen in and of itself is not going to include an active mining component, the investment in Kentucky's mining workforce can contribute to the productivity of the workforce that will deliver Kentucky coal to the project.

5) Kentucky's Energy Research Capacity:

In the last year, the Kentucky Office of Energy Policy has awarded over \$3.2 million in energy research and development grants. As noted before, the Kentucky Office of Energy Policy will be managing \$7 million in research and development funds over the next two years. It welcomes the opportunity to coordinate and participate in the funding of any specific research needs of the FutureGen project with its research institutions.

Kentucky has a substantial energy research base within its universities. Kentucky's energy research capacity is contained within a number of institutions – which include:

- Kentucky Geological Survey at the University of Kentucky
- The Center for Applied Energy Research at the University of Kentucky
- The Institute for Combustion Sciences and Environmental Technology at Western Kentucky University

Recent research grants that may be of interest to the FutureGen Alliance include:

- \$170,000 to the Kentucky Geological Survey for research in carbon sequestration.
- \$98,000 to the Center for Applied Energy Research at the University of Kentucky for research into the production and purification of hydrogen.
- \$352,000 to the Institute for Combustion Sciences and Environmental Technology at Western Kentucky University for research into mercury control technologies.

Conclusion

The Commonwealth of Kentucky applauds President Bush, the Department of Energy and the FutureGen Industrial Alliance for putting forth the FutureGen vision. Kentucky's proposal offers a tremendous set of attributes that would provide the Alliance with an excellent location to construct the FutureGen project. The Commonwealth of Kentucky welcomes the opportunity to compete for the FutureGen project and looks forward to working with the Site Selection team as they consider where to make history with the FutureGen facility.